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Significance of California Air Pollution Control Regulations for Business Location Decisions

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

AIR RESOURCES BOARD
Research Division

Significance of California Air Pollution Control Regulations for Business Location Decisions

Final Report

Contract No. 92-349

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Dr. Larry Butler, Southern California Edison
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Ms. Cecelia Estalano, Environmental Protection Agency
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Mr. Barry Sedlick, Southern California Edison
Mr. Steve Sullivan, Los Angeles County Federation of Labor AFL-CIO
Mr. Perry Tribolet, Southern California Edison
Dr. Barry Wallerstein, South Coast Air Quality Management District

In addition, Mr. Kirk West, President, California Chamber of Commerce, provided a letter encouraging businesses to respond to the IEES survey. His help is gratefully

(5) Business relocations were not a significant factor in explaining California job losses. Moreover, not all business relocations are related to the state's business climate.

(6) Air quality regulation is just one of the factors in business location decisions. Labor costs, taxes, and workers compensation are the leading factors affecting business location. This should not be interpreted to mean that air quality regulations did not affect any relocations. The regulations may have affected individual relocation choices.

(7) The impacts of air quality regulations require continuing analysis. Air quality regulators have recently made a number of efforts to improve the regulatory and permitting processes including the use of market based incentives and special assistance provided to small businesses.

ABSTRACT

This study examined the relationship of air quality regulations and business location decisions in California. The evidence analyzed included studies of the California business climate, academic literature on business location decisions, data on air pollution control costs, responses to an IEES (Institute for Economic and Environmental Studies) survey of firms subject to air quality regulations, and trends in economic growth and business relocations in California for 1990-1993.

Based on this evidence, the following sets of findings have emerged:

(1) There is a clear dichotomy between business perceptions and the actual cost of air quality regulations. While the business managers are clearly angry at government regulations and view them as costly to business, there is little reliable, quantitative data which supports the conclusion that heavy costs are imposed on the economy by air quality regulations.

(2) We did not find that air quality regulations created significantly higher costs for California industries compared to those in other states. Data showed that one-half to two-thirds of the total estimated expenditures on compliance are in two industries -- electric utilities and petroleum products -- which account for less than 1% of the state's job base.

(3) We found that business executives view air quality regulations as unnecessarily burdensome. They expressed anger and frustration in dealing with the California air quality regulations. Their concerns dealt both with the direct compliance costs of air quality regulations and with the time and uncertainty costs involved in the permitting/regulatory process.

(4) Recent California job losses were caused primarily by specific industry trends. The major causes were construction over-building, a sharp drop-off in civilian and military aerospace demand, and a decline in real spending far beyond the decline in real income.

Table Of Contents

List of Figures

List of Tables

Executive Summary

The study examined evidence about the relationship of air quality regulations and business location decisions in California. In particular, it has focused on examining the relationship of air quality regulations to business location decisions and economic trends in California in the 1990-1993 period—a time of substantial recession in the state's economy.

Many different kinds of evidence were analyzed:

- Studies of the California business climate (Chapter 2)
- Academic literature on location decisions (Chapter 3)
- Air pollution control cost data from the U.S. Department of Commerce and South Coast Air Quality Management District (Chapter 4)
- A survey, conducted as part of the study, of firms subject to air quality regulations in California (Chapters 5 and 6)
- Trends in economic growth and business relocations in California for the 1990-1993 period (Chapter 7)

Based on this evidence, seven principal sets of findings have emerged:

2. California Air Quality Regulations Costs Are Not Significantly Higher Compared To Those In Other States.

The study was designed to gain information on the direct costs of compliance with air quality regulations through a survey of affected firms. However, the survey results did not provide usable quantitative results. As a result other evidence was reviewed to provide insights into the direct costs of compliance in California.

Most respondents in our survey were unable to quantify specific costs of complying with air quality regulations. This made it impossible to calculate reliable numerical estimates of pollution control costs by industry. Nonetheless, the extensive qualitative information collected provided useful insights into the ways air quality regulations affect operations of various industries and firms. Impacts on the quality and quantity of output, for example, are quite different as are those on goods for production for local consumption versus those sold on the national market. The results also point out the need for careful analysis when interpreting the currently available data on the costs of compliance with air quality regulations. More research is needed to explore these issues further.

The business climate studies reviewed in Chapter 2 did not include any evidence on the direct costs of compliance with California air quality regulations. The Special Commission on Air Quality and the Economy formed in 1991 by the South Coast Air Quality Management District concluded that "the Commission is not able to produce an aggregate estimate of job loss or business closures for the region."

Data compiled by the U.S. Department of Commerce, reported in Chapter 4, found no significant differential costs of air pollution control in California. These data refer only to the manufacturing sector of the economy. Air quality regulations do apply to some non-manufacturing industries but in the absence of any independent data for these industries all the conclusions discussed here are applicable only to the manufcturing sector.

1. There Is A Clear Dichotomy Between Business Perceptions And The Direct Costs Of Air Quality Regulations.

The business survey conducted by the project team, review of numerous studies, and feedback from the business community all clearly indicate that businesses are angry and blame most government regulations as a costly hindrance to normal business activity. Business climate surveys have captured these sentiments time and again.

At the same time, however, there is little reliable *quantitative* data available in any of the existing studies or government statistics which support the notion of heavy costs imposed on the economy by air quality regulations.

The evidence that we were able to collect on the costs imposed on individual industries by air quality regulations, and there *is* evidence of that, does not fully explain the level of frustration and anger we perceived in the responses of businesses to our survey.

Some basis for this dichotomy between the business perceptions and cost data regarding the impact of air quality regulations may lie in the changing climate of public opinion about the role of government regulations. Respondents to the business survey also had strongly negative opinions of other government regulations such as environmental and land use permittitng, the legal liability system ("tort reform"), and the workers compensation insurance system.

Another explanation may be found in the frustration businesses feel dealing with the *process* of regulation rather than the actual expense of compliance. The respondents appeared particularly perturbed by the "hassle" they feel in the permitting and compliance processes.

Additionally, this study was conducted during a period of serious economic downturn in the California economy. While the actual costs of compliance are less sensitive to recessions, the perceptions are more likely to be influenced by an adverse economic climate.

were firm size and growth, export or local demand for firm's products, and firm ownership and product features.

The responses in our survey were essentially bipolar; very small firms (under 100 employees) and very large firms (over 500 employees) expressed greater frustration than other firms. Rapidly growing family-owned firms, those competing heavily in markets outside California, as well as mass producers of standardized products were more critical than other types of firms. Firms least likely to express major concern over air quality regulations were slow growing partnerships or corporations (especially branch plants), firms having 100-500 employees, firms competing mainly in local markets, and producers of nonstandardized goods.

4. California Job Losses Were Primarily Caused by Specific Industry Trends.

California lost between 500,000 and 600,000 jobs during the 1990-1993 recession. Half of these job losses were in the manufacturing sector, while more than 100,000 jobs were lost both in construction-related industries and in retail trade.

Our analysis indicates that California's job losses were the result of specific industry and economic trends—not business relocations or a general decline in business climate. The three principal causes of California job losses were:

- A decline of two-thirds in construction activity in California beginning with a period of over-building that ended in 1989.

- A sharp decline in both civilian and military related aerospace markets. More than 100,000 direct aerospace jobs were lost as a result of defense spending cuts and commercial market declines.

- Operating and capital costs for air pollution control were less than 0.5% of sales in manufacturing industries in 1991 in all states.

- California's ratio of air pollution control costs to sales was 0.29%— slightly higher than the 0.26% national average.

- California's above average cost/sales ratio was caused by the large expenditures on air quality compliance in one industry—petroleum products.

Data from the South Coast Air Quality Management District, reported in Chapter 4, show that air pollution control costs in California are highly concentrated in industries with relatively low employment. Over 50% of the total air pollution cost expenditures are in two industries—electric utilities and petroleum—which together contain fewer than 1% of the region's job base.

3. Business Executives Feel That Air Quality Regulations Have Been Burdensome.

The testimony of business executives from the business climate studies reviewed in Chapter 2 and the responses to our own surveys show a clear picture of anger and frustration in dealing with California air quality regulations.

Business climate surveys rated environmental regulations as one of the major negative factors in California's business climate. Some of the studies specifically identified air quality regulations as a problem. Whenever air quality regulations were identified specifically, two areas of concern were raised. Business executives expressed concern with the direct compliance costs of air quality regulations and with the time and uncertainty costs involved in the permitting/regulatory process.

Our survey also found differences in the impacts of air quality regulations based on organizational and operational characteristics of the firms studied. Among the important factors

Jobs lost from relocations rose only slightly during California's recent recession. Job losses in 1990, 1991 and 1992 totalled 64,413 (including lost expansions and unverified losses) compared with 52,719 during 1987, 1988 and 1989.

Southern California Job and Facility Losses Due to Relocations and Expansions: 1980-1993

Year	Facilities	Jobs
1980	34	5,351
1981	30	8,324
1982	48	11,495
1983	45	8,126
1984	48	7,531
1985	71	15,657
1986	81	8,522
1987	116	20,612
1988	109	14,468
1989	138	17,639
1990	176	29,531
1991	203	16,648
1992	228	18,234
1993 (est.)	105	4,955

Source: Bules and Associates

This small change in the number of relocations (even if all were the result of business climate factors and all of these related to air quality regulations) is not a significant factor in California's recent job losses. Moreover, relocations fell in 1993 when the economy was still struggling to recover.

- Total retail spending fell far more than income losses would normally have caused as a result of declining consumer confidence. Total retail spending adjusted for inflation declined by 10% between 1990 and 1993 even though real income remained constant.

Most job losses occurred in Southern California which suffered most of the aerospace job losses and had the most severe construction decline. Some areas of the state (e.g., the Sacramento region, parts of the Central Valley, and the Riverside-San Bernardino area) added jobs between 1990 and 1993. These trends confirm the importance of specific factors—rather than a generalized decline in business climate—in explaining California's deep recession.

5. Business Relocations Were Not a Significant Factor in Explaining California Job Losses.

Relocations have always been part of the California economy. Firms have relocated into and out of California both when the economy was growing and when the economy was declining.

Moreover, not all business relocations are related to the state's business climate. The business climate surveys analyzed in Chapter 2 show that many other corporate considerations—market factors, corporate business strategy, and sometimes the personal preferences of company executives—affect location decisions as well as cost, regulatory, and quality of life conditions.

A major study of manufacturing sector business relocations, reported in Chapter 7, shows the variability of trends in business relocations. The principal results are shown below. Relocations include actual relocations and expansions that go elsewhere and include verified data and an allowance for unverified relocations.

- The use of market based approaches to meeting air quality goals has increased. Market based approaches allow flexibility in response to air quality goals as opposed to the "command and control" approach which prescribed both the goals and the specific approach to meeting the goals.

- Example of market based approaches are the RECLAIM Program which encourages development and trading of emission credits to lower the cost of compliance and old vehicle scrappage programs which allow businesses an alternative approach to reducing total air pollution emissions.

New programs to reduce the time and uncertainty costs of permitting have been initiated. The South Coast Air Quality Management District has developed a Small Business Assistant Office to help small businesses understand and comply with the District's rules. In addition, the AQMD has a set of New Direction Reforms that focus on easing compliance, business relations and developments, and the market based programs discussed above. The AQMD reports the following progress under the New Directions Program.

AQMD'S New Directions Report Card

REGULATORY REFORMS
- Market Incentives
- Rideshare Rule Streamlined
- Extended Deadlines

PERMIT REFORMS
- Reduced Turnaround Time
- Industry Teams
- Privatization
- Convenience
- Fee Restraints

COMPLIANCE REFORMS
- Education & Assistance
- Variance Reforms
- Creative Penalty Program

BUSINESS ASSISTANCE
- Increased Outreach
- Customer Service

PIONEERING PROGRAMS
- Business Retention
- Technology Advancement

6. Air Quality Regulations Are Just One Factor in Business Location Decisions.

Air quality regulations were only one of many business climate factors identified both in the business climate surveys reviewed in Chapter 2 and the special survey conducted for this study. Other factors affecting location decisions include workers' compensation insurance, taxes, litigation issues, land use permitting, and health care costs.

Most studies rated labor costs, taxes and workers compensation as the leading business climate concerns. While many studies mentioned regulations in general and air quality regulations specifically, air quality regulations were not identified as one of the two or three significant causes of the relocations that did occur.

7. The Impacts of Air Quality Regulations Require Continuing Analysis.

Our study focused on analyzing the impacts of air quality regulations on the overall economy between 1990 and 1993. The study did not investigate the future impact of existing or planned air quality regulations.

Analyses of future economic impacts are regularly conducted as part of the development of air quality management plans by local air quality management districts throughout California. For example, the AQMD uses a regional economic impact model and other analytical tools to analyze the future impacts of new regulations on the regional economy.

Our study found concern among business executives for the way in which air quality regulations are implemented. Since these concerns were originally voiced, air quality districts have responded with some changes in procedure. The changes noted below were not evaluated as part of this study.

Chapter 1

INTRODUCTION

Public agencies that develop regulations to achieve public policy objectives are nearly always engaged in an ongoing debate about the effectiveness and equity of those regulations. Air pollution control regulations in California have been an integral part of the overall environmental policy since the early sixties. Significant improvements have been made in the quality of air over these years especially in the heavily polluted areas of Southern California, and there has always been public awareness that improvements in environmental quality come at a price. However, in both the United States and in California there has been an ongoing debate about the effects of air quality regulations on business costs and business location decisions as well as on whether the regulations are adequately achieving the objective of reducing air pollution.

The California economy, following the national economy, went into a severe recession in 1990. The state suffered some of its worst losses in incomes and jobs during 1990-93. The comparatively poor performance of the California economy led to a number of studies of why the state's economy was lagging. Many of these studies focused on a set of issues that became known as business climate issues including workers' compensation insurance, environmental regulations, permitting policies, taxes, and litigation reform. While most of the studies dealt primarily with business climate issues other than environmental regulation, some included air quality regulations as one of the concerns of the business community and policymakers.

These studies were based on the premise that business climate issues have an impact on business location decisions. Such decisionmaking is quite complex in practice. Various cost and strategic considerations play important roles in location decisions by businesses. One mechanism through which regulatory impacts manifest themselves is by affecting the cost of production of goods and services. By imposing higher costs on regulated businesses these regulations make California less competitive than other states. Additionally, the argument goes,

costs to manufacturing firms associated with air pollution control equipment are regularly compiled by the U.S. Department of Commerce for major industries across all states. These data are supplemented by selected pollution control cost data from studies conducted by SCAQMD.

The Institute for Economic and Environmental Studies conducted a survey of firms subject to air quality regulations in California. Chapter 5 describes the design, methodology, and data of the business survey. The results of the business survey are discussed in Chapter 6. In addition to gathering data on costs of compliance, the survey investigated the impacts of air quality regulations on the operations of firms with different characteristics.

Chapter 7 examines the actual performance of the California economy since 1990. The focus is on what happened and why. We ask the question "Does the evidence on job trends by industry compared with the claims about 'business flight' and poor business climate support the hypothesis that air quality regulations contributed significantly to California's comparatively poor job and income performance between 1990 and 1993?"

Related Issues:

This study, by design, had a relatively narrow focus. Our charge was 1) to review the literature on air quality regulations and business location decisions; 2) to conduct a survey of firms subject to current California air quality regulations; and 3) to analyze the connection between air quality regulations, business location decisions, and the recent long California recession.

This study did not investigate the impact of current or prospective air quality regulations on California's future economic growth. These issues are regularly addressed in the planning process of air quality management districts in the state. Nor did the study analyze the potential positive economic impacts of air quality regulations. Two major areas of potential positive economic impacts are: 1) the impact on location decisions of having clean air in California and 2) the potential for creating new technology industries in California to meet air pollution control

compliance with air quality regulations is cumbersome and frustrating, thus prompting firms to move out of the state.

The questions of whether air quality regulations had contributed significantly to California's economic downturn and business relocations were raised to the California Air Resources Board (CARB). While cost data are prepared by air quality management district for analysis of each new rule, these data were not sufficient or complete enough to conduct the desired economic analyses. This project was commissioned to study these concerns.

We have analyzed these issues during the past eighteen months using available and newly collected data and evidence. Included in this analysis are a critical evaluation of existing business climate studies and academic literature as they relate to the impacts of air quality regulations in California, the economic performance of the California economy since 1990, and a comprehensive survey of California's business firms affected by air quality regulations.

The Center for Continuing Study of the California Economy under Stephen Levy supplied the material discussed in chapters 2, 4, and 7, and provided major input throughout the project. Kelly Robinson, Center for Public Policy Research, Rutgers University made significant contributions to the literature review and project survey analysis.

The results of this project are described in the following chapters. Chapter 2 critically evaluates California business climate studies and the role of air quality regulations. The focus is on examining what was actually said about air quality regulations and the environment. Selected studies from outside of California are also reviewed in Chapter 2.

Chapter 3 analyzes the academic literature on business location. The focus is on identifying the nationwide evidence about the importance of environmental regulation in general, and air quality regulations in particular, on business location decisions.

Cost data from two published sources- the U.S. Department of Commerce and the South Coast Air Quality Management District - are analyzed in Chapter 4. Data comparing the

Chapter 2

CALIFORNIA BUSINESS CLIMATE SURVEYS: THE ROLE OF AIR QUALITY REGULATIONS

During the 1990-1993 period the California economy lagged the nation in the growth of jobs and income. While the national economy started to recover from recession in mid 1991, the California economy remained in a downturn into 1993.

The comparatively poor performance of the California economy led to a number of studies of why the California economy was lagging. Many of these studies focused on a set of issues that became known as business climate issues including workers compensation, environmental regulations, permitting policies, taxes, and litigation reform.

This chapter includes a review of the major California business climate studies prepared in the early 1990s with a focus on what the studies actually said about the role of air quality regulations in California's economic downturn. Chapter 7 presents an explanation of where the job losses occurred in California and an analysis of the possible role of air quality regulations in the state's job losses.

2.1 Major Determinants of Business Location Decisions

To understand the role of air quality regulations in business location decisions, it will be useful to have a brief summary of the major locational determinants. Firms make locational decisions based on many factors. Likewise, state and regional economic competitiveness depends on many factors.

standards here and in other regions and foreign markets. These impacts are being analyzed in new work being conducted by the South Coast Air Quality Management District. Analysis of Regulation 15 dealing with ride-sharing was also not a part of the study since it has been studied by SCAQMD.

The study did not extend to interviews with the firms which have left California in recent years. During the design phase of the study it was decided, in consultation with the CARB, that this would be a major project in its own right and should best be carried out as a separate study at another time. We did, however, review the evidence on this subject produced by other studies.

Finally, the study did not investigate what would have happened if air quality regulations had not existed or had set much lower air quality standards. There is no work known to any of the study team which is oriented to the question of how the economy might have performed in a different air quality regulatory environment.

Figure 2.1

Principal Determinants of State and Regional Economic Competitiveness

- Business Costs
  - Wage Rates
  - Housing Costs
  - Land Prices
  - Utility Rates
  - Tax Rates
  - Regulation Costs
    - **Air Pollution Control Costs**
  - Workers Compensation & Health Costs
- Workforce Quality
  - Education
  - Training
- Public Infrastructure
  - Highways & Mass Transit
  - Ports & Airports
  - Telecommunications
  - Water Systems & Solid Waste Disposal
- Quality of Life
  - Good Education System
  - Recreation & Open Space
  - Low Crime
  - **Air Quality**
- Regulatory Environment
  - Streamlined Permitting
    - **Air Quality Regulations**
  - Legal Liability Reform
  - Malpractice Reform

Some locational determinants can be measured quantitatively. These factors include business cost variables like wage rates, housing costs, land prices, taxes, workers compensation rates, and utility costs. Many costs of air quality regulations can also be measured quantitatively.

However, locational choices depend on many factors besides **measurable**, direct quantitative business costs. There are four other categories of locational determinants.

Workforce Quality
Public Infrastructure
Quality of Life
Regulatory Environment

Some of the key locational factors in each category are shown on Figure 2.1.

Air quality regulations appear three times on the list of locational determinants. The direct capital and operating costs of pollution control equipment are a direct business cost. The qualitative dimensions of air quality regulations, e.g., the user friendliness of regulatory implementation, are one of the often mentioned issues about the region's regulatory environment.

Air quality regulations also can make a positive contribution to economic competitiveness. Better visibility and a reduction in health costs can make California a more attractive location for firms that can choose in what region to establish facilities.

The relative importance of each factor on locational decisions and regional competitiveness depends on the specifics of each case. Wage costs may be the most important locational determinant in one situation, while for other firms good quality schools and high quality of life may be critical in attracting the kind of workforce they require.

Mark Baldassare and Associates, *1994 California Business Roundtable Survey: California Business Leaders and Voters*, November 10, 1994.

2.2.1 SCAQMD Special Commission on Air Quality and the Economy

In December 1991, the South Coast Air Quality Management District Board established a Special Commission on Air Quality and the Economy. The Commission was directed to take public testimony and then to report on the impact of air quality regulations on the economy and on the District's efforts to reduce the cost of compliance with its regulations.

The Commission reported in July 1992 :

The Commission quickly recognized that no definitive, quantifiable conclusions can be reached concerning the impact of air quality regulations on the economy, especially in a time of severe economic recession and restructuring. The Commissions also recognized that the District has responded to some concerns about the intrusiveness of air quality rules through the implementation of its New Directions, Small Business Assistance, and proposed RECLAIM programs.

What the Commission has found, in general, is that significant numbers of the regulated community - Federal and State agencies, schools, businesses, and individuals - continue to perceive the District's programs as having an unnecessarily harsh economic impact on their operations. This perception alone can have a fundamental impact on the air basin's business climate and public support for air quality programs.

The Commission actively sought specific, quantitative information on economic impacts, and the testimony provided useful case histories of the impacts of air quality regulations on business. However, the Commission is not able to produce an aggregate estimate of job loss or business closures for the region. The Commission cannot draw quantitative conclusions from the testimony for three major reasons: 1) the testimony is not a random selection of businesses nor is it a large enough sample of businesses to be representative; 2) it is difficult to separate the effect of SCAQMD air quality regulations from other factors that affect business decisions, including the current recession; and 3) the Commission did not independently verify claims made in public testimony.

2.2 California Business Climate Studies

The recent upsurge in interest in business location decisions has occurred during the long California recession as a series of studies and reports have analyzed the state's business climate. Six of these California business climate studies were selected for review in this project.

Air Quality Regulations and the Economy, Special Commission on Air Quality and the Economy South Coast Air Quality Management District, July 10, 1992.

California's Jobs and Future, Council on California Competitiveness, April 23, 1992.

An Analysis of California's Economy, July 1992, California Business Roundtable.

Toward an ADEPT California: A Preliminary Report of the Assembly Democratic Economic Prosperity Team (ADEPT).

Mark Baldassare and Associates, *1993 California Business Roundtable Survey: California Business Leaders and Voters*, October 18, 1993.

California Industry Migration Study: Recent Trends in California Industry Migration 1987-1992, October 19, 1992

Two additional studies were reviewed to provide information on business climate studies conducted both before and after the 1990-1993 recession. These two studies were a 1988 analysis conducted by the California Economic Development Corporation and the 1994 California Business Roundtable Survey.

Vision: California 2010, A Special Report to the Governor by the California Economic Development Corporation, March 1988.

Within the Regulatory Streamlining issues environmental concerns are one area of concern.

Regulatory Streamlining
- Agency Funding and Oversight
- Land Use Problems
- Environmental Problems
- Amend Injury and Illness Prevention Program

Within the Environmental Problems area air quality is included along with water and other environmental issues.

As a result, air quality regulations appear as one in a long list of problem areas that the Council identified in their review and testimony process. The Council did not attempt to assess the relative importance of specific problem areas.

The Council wrote in support of both maintaining environmental quality in California and having a healthy economy.

> California cannot restore its competitiveness by allowing the degradation of its environment. As a state with a widely varied and sometimes delicate ecology, California must make continuing efforts to maintain a clean and healthy environment. California must also have a healthy economy to produce and retain jobs and to supply resources for investment in environment, education, infrastructure, and other social needs.
>
> Testimony presented to the Council removed any doubt that California's regulatory system and permit processes have gotten out of control. (Council of California Competitiveness, 1992).

Despite this limitation, the commission collected evidence on how regulations affect profitability, competitiveness, and the business climate. The Commission found a broad range of impacts on business operations - much more than simply the cost of buying pollution control equipment. Examples of firms closing, relocating, contracting, or not expanding were also provided. This evidence is important and deserving of serious consideration by the District.

CONCLUSION:

1a) SCAQMD regulation have decreased the profitability and competitiveness of many affected businesses.

1b) SCAQMD regulations and regulatory activities have contributed to the worsening of the business climate.

1c) SCAQMD regulations have been a contributing factor in some regional job losses. (South Coast Air Quality Management District, 1992).

2.2.2 Council on California Competitiveness

The membership of the Council on Competitiveness was introduced by Governor Wilson in December 1991 with Peter Ueberroth as the Chairman. The Council was charged with finding ways to remove the barriers to creating jobs and increasing state revenues in California.

The Council was divided into task forces on specific topics. The Council reviewed existing studies and heard testimony before preparing a report in April 1992.

The Council report is focused on seven problem areas:

Role of Government
Workers Compensation
Regulatory Streamlining
Capital and Economic Incentives
Education and Training
The Legal System
Support Critical Industries

The fourth deficiency - private capital investment - is at least partly related to what is perceived as California's negative business climate. Surveys have identified a number of factors that business finds to be major impediments to locating jobs in California and to making the kinds of investments that make workers more productive. These factors include such issues as labor and related costs (workers' compensation, health care), taxes and liability laws. California does indeed compare unfavorably to most of its neighbor states in many of these dimensions. (California Business Round Table, 1992).

The BCG report identifies several other business cost areas ahead of air quality regulations in affecting business location decisions. As shown on Figure 2.2, air pollution controls rank behind workers compensation, other business taxes, health care costs, liability laws, local fees/taxes, cost of housing, cost of labor, health care system, toxic regulation, and the 1991 state budget agreement as having a bad effect on the state's business climate.

The BCG report concludes that the complete set of business climate issues is a problem area.

BCG believes that the state's poor receptiveness to business and business expansion is a major impediment to near term job growth. While no data are available on the loss of jobs due to the business climate, it is clear that California is poorly regarded by those making job location decisions. These perceptions are supported by at least some realities: the ineffectiveness of the state in providing consistently good public educator, training its workers, providing for an improved quality of life, and welcoming job creation and retention. (California Business Round Table, 1992)

2.2.3 California Business Roundtable - An Analysis of California's Economy

The California Business Roundtable sponsored a study of the California economy prepared by the Boston Consulting Group (BCG). Their report, published in July 1992 identified four areas as important determinants of economic growth in California.

Public Investment in education
Public investment in infrastructure
Private investment in R&D
Private investment in plant and equipment

As shown in the report excerpt below, the business climate issues are one piece of the key factors in private investment decisions.

In California, as in other major economies, economic growth can be expected to correlate closely with increases in worker productivity. Productivity growth, in turn, is driven by four basic forces - public investment in education and in infrastructure and private investment in research and development and in plant and equipment. California is among the leaders in one category: R&D spending. As a percent of gross domestic product, it is much higher than elsewhere in the U.S. and it rivals that of world class-economies such as Japan and Germany.

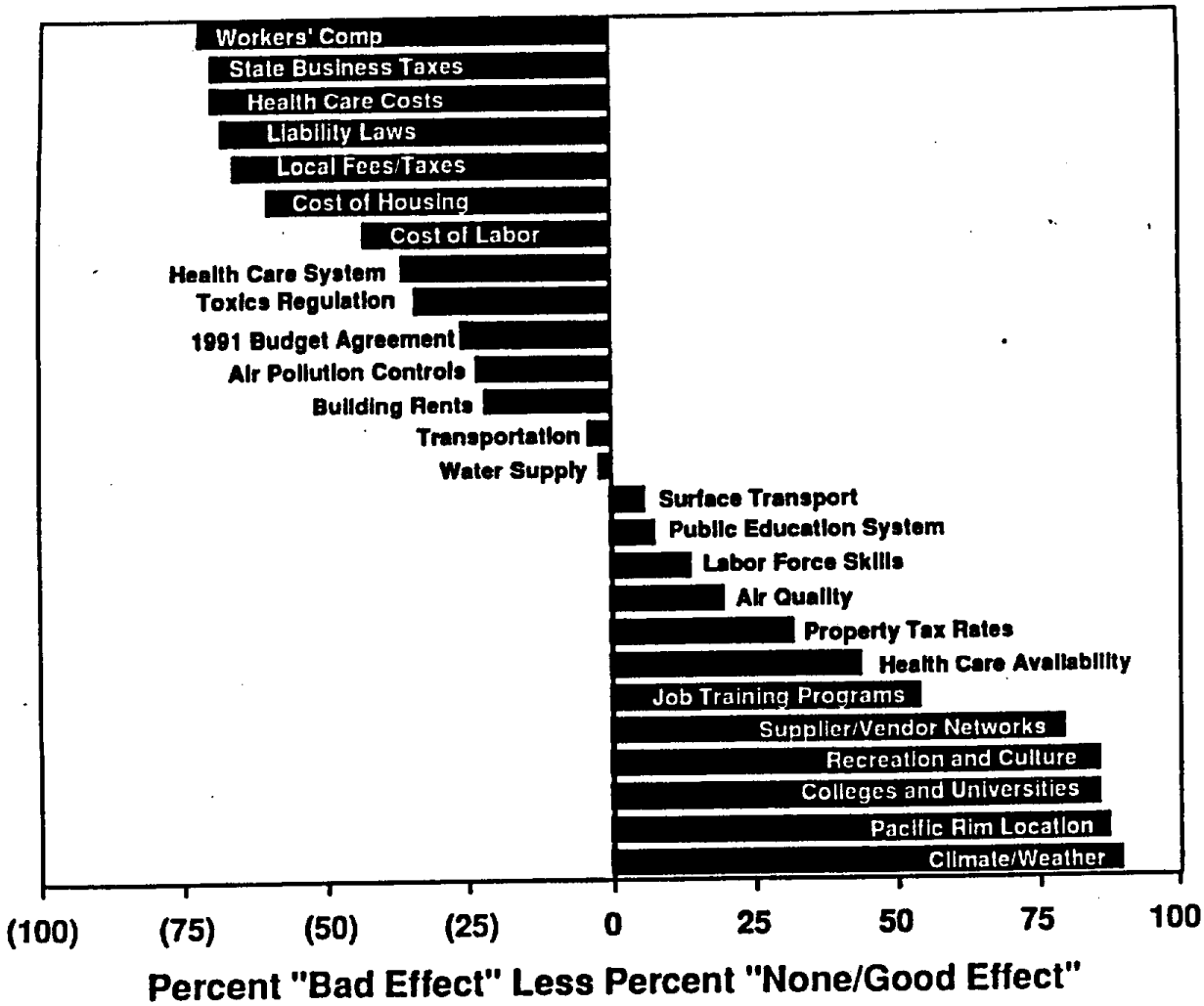
The problem is that California does not appear to retain the production and other jobs that this spending creates. This is a symptom of relatively uncompetitive growth in worker productivity, and it can be traced to deficiencies in the other three factors. California is fairly similar to the U.S. in total, and compares poorly with economies such as Japan and Germany, in these three measures:

- Investments in public infrastructure
- Effectiveness of the K-12 education system
- Private capital investment in plant and equipment.

As has been discussed widely, increased investment in public infrastructure and improved quality of K-12 education needs to be brought much closer to the superior level of higher education in California, which is a significant asset.

Figure 2.2

Business Climate Makes It Harder for Companies to Invest in Worker Productivity



Source: CBR 1991 California Business Climate Survey

The fourth deficiency - private capital investment - is at least partly related to what is perceived as California's negative business climate. Surveys have identified a number of factors that business finds to be major impediments to locating jobs in California and to making the kinds of investments that make workers more productive. These factors include such issues as labor and related costs (workers' compensation, health care), taxes and liability laws. California does indeed compare unfavorably to most of its neighbor states in many of these dimensions. (California Business Round Table, 1992).

The BCG report identifies several other business cost areas ahead of air quality regulations in affecting business location decisions. As shown on Figure 2.2, air pollution controls rank behind workers compensation, other business taxes, health care costs, liability laws, local fees/taxes, cost of housing, cost of labor, health care system, toxic regulation, and the 1991 state budget agreement as having a bad effect on the state's business climate.

The BCG report concludes that the complete set of business climate issues is a problem area.

BCG believes that the state's poor receptiveness to business and business expansion is a major impediment to near term job growth. While no data are available on the loss of jobs due to the business climate, it is clear that California is poorly regarded by those making job location decisions. These perceptions are supported by at least some realities: the ineffectiveness of the state in providing consistently good public educator, training its workers, providing for an improved quality of life, and welcoming job creation and retention (California Business Round Table, 1992).

4. The national credit crunch limiting capital availability to finance the ongoing operations and expansion of California business;

5. The uncompetitive costs of doing business in California;

6. The failing California educational system;

7. The very success of California leading to pressures on the economy and the environment;

8. The falling investment in California's public infrastructure;

9. The lack of foresight and planning for California;

10. The complacency that has prevented California from taking early action to respond to the warning signs of the current crisis; and

11. The failure of government and business to act collaboratively to solve the problems we mutually face.

The ADEPT report stresses that environmental protection should not conflict with economic growth.

Even as we must protect the environment in which we live, we must as well develop processes for accomplishing that which are clear, coherent, fair, and come to closure much more expeditiously. The ready commitment of most all the business leaders we conversed with to maintaining the goals and standards for protecting our environment provides us encouragement that with enough good work and good will, we can accomplish such a streamlining of our environmental protection and permitting processes, at every level of government.

2.2.4 Assembly Democratic Economic Prosperity Team (ADEPT) Reports

A group of Democratic members of the California Assembly conducted a series of hearings on the California economy. The ADEPT group, formed in December 1991 at the same time as the Council on California Competitiveness, prepared reports in 1992, 1993 and 1994.

The general findings of the ADEPT report are similar to the studies reviewed above.

- The reports identified a long list of problem areas in the California economy.
- One problem area was uncompetitive costs of doing business in California.
- One area of business cost concerns was regulatory issues.
- One portion of regulatory issues was related to air quality regulations.
- No quantitative estimates of the relationship of air quality regulations to the California economy were identified.

The list of causes of economic problems identified by ADEPT stresses planning, public investment, and structural change more than some of the other studies and places strong, but comparatively less, emphasis on business cost issues.

The root causes of the economic distress and negative business climate are complex. To design effective solution for our current economic crisis, we have identified ten major root causes:

1. The national recession;
2. The ending of the Cold War with its resultant military and aerospace contraction;
3. The poor understanding of the requirements of the changed global economic structure in which California businesses must compete;

Problem Areas in California's Business Climate

Question: What effect do each of these (factors in the business environment) currently have on your business in California?

	% Rating Bad	
	1990	1991
Cost of housing	77%	80%
Cost of labor	74%	73%
Health care costs	68%	85%
Surface transportation	53%	47%
Building rents	52%	61%
Skills of labor force	51%	43%
Air quality	51%	40%
Foreign business presence	22%	
Water supply		51%

Question: What effect does each of these (state policy areas) currently have on your business in California?

	% Rating Bad		
	1991	1992	1993
Workers compensation	86%	90%	92%
Liability laws	84%	89%	90%
Health care costs	85%	92%	89%
State business taxes	85%	83%	86%
State budget	63%		
Air pollution controls	62%		79%
Permitting process		67%	67%
Public Education	46%	46%	47%

2.2.5 California Business Roundtable - Business Climate Surveys

Since 1990 the California Business Roundtable has conducted an annual survey. In 1990 and 1991 the survey focused on business leaders and was titled, *The Business Climate Survey.* In 1992 and 1993 the survey included voters and was titled, *The California Business Roundtable Survey.*

Some key survey findings are:

Business leaders views about the California economy have grown more negative since 1990.

- Business leaders have consistently cited a long list of policies that have a "bad effect" on business. Air quality regulations are included in the general category of business permitting issues which are not in the top five factors usually mentioned.

- Approximately 25% of the business leaders were considering plans to expand or relocate outside California. Air quality regulations were cited as one factor but were not among the top five in terms of frequency.

Perception of California Economy

Question: Generally speaking, how would you rate business conditions in California today?

% Rating Conditions Negative				
	1990	**1991**	**1992**	**1993**
The State	26%	70%	93%	94%
The Nation	43%	60%	66%	51%

Question: What are the most important reasons for out of state relocations and expansions?

	Relocation	Expansion
Taxes	21%	19%
Anti-business policies	18%	16%
Workers compensation	17%	8%
Environmental/air regulations	16%	8%
Labor/salary costs	10%	13%
Business costs	5%	5%
Better opportunities	3%	14%
Other	4%	5%
Don't know	6%	12%

Specific Questions on Environmental Policies:

1990

Air quality was listed as having a bad effect on "your business" by 51% of the business leaders.

Stricter air quality regulations were favored by 55% of business leaders and stricter toxics restrictions were favored by 50% of surveyed business leaders.

1991

Air quality was listed as having a bad effect on "your business" by 40% of business leaders.

On the other hand, air pollution controls were listed as having a bad effect by 62% of the survey respondents.

Relocation

The California Business Roundtable has conducted an annual survey of business leaders since 1990 and has included questions on relocation plans. The 1993 survey reports the following results (Mark Baldassare and Associates, 1993) .

Question: Does your company have plans to relocate operations **outside** the state?

	1993	1991
Yes, all operations	6%	8%
Yes, some operations	18%	15%
No	76%	77%

Question: Does your company have plans to expand operations **outside** the state?

	1993	1991
Yes	25%	24%
No	75%	76%

In 1991 a more detailed question was asked about the reasons for out of state relocations and expansions.

- Direct business cost items (e.g., labor and real estate) were the most often cited concerns.

- The general category of regulatory and permitting issues was cited often as an area of concern.

- There were no specific findings on air quality regulations.

- Concerns with regulations usually focused on the permitting process more than regulatory goals or stringency.

As shown on Figure 2.3, business leaders mentioned several other categories - direct business costs, business requirements, business strategy, and quality of life - as well as business climate issues in explaining their relocation decisions. Moreover, as shown on Figure 2.4, only half of the respondents mentioning business climate issues identified the overall category of environmental regulations as being important. Air quality regulations were not separately identified in the responses.

Estimates from this study of the number of jobs associated with business relocations and out of state expansions are discussed in Chapter 7.

In 1991 stricter air quality regulations were favored by 32% of the business leaders.

1992 and 1993

Business leader respondents favored

	1992	1993
Streamlining the permitting process for business	89%	91%
Speed up the processing of permits	89%	
Consolidate environmental permitting into a one-step process	84%	88%
Create a state panel of independent scientists to evaluate health risks	60%	
Reduce some of the environmental regulations placed on businesses		74%

The other questions asked in 1990 and 1991 were not repeated in 1992.

2.2.6 Utility Sponsored California Industry Migration Survey

The utility sponsored California Industry Migration study findings were consistent with the main findings of the other survey based studies.

- The surveyed firms cited a long list of problem areas in California's business climate.

Figure 2.4

Causes of Industry Migration

OTHER BUSINESS CLIMATE
(62% Mentioned)

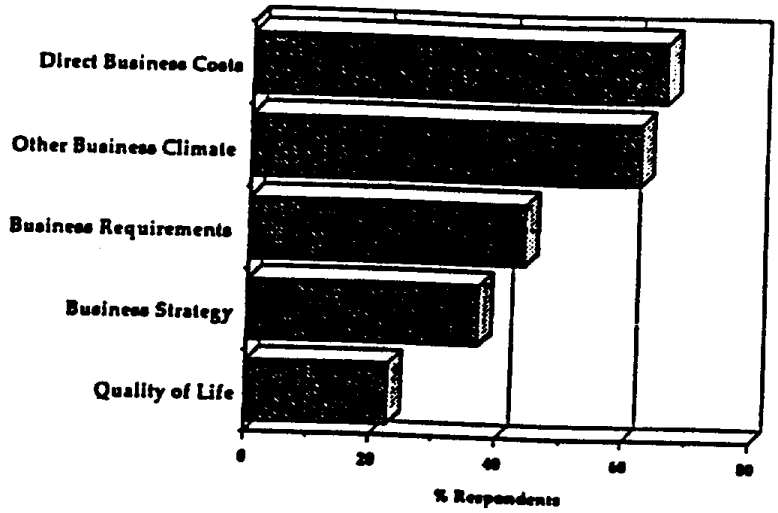
Factors	% Total Respondents Expansions	Relocations	Overall
State Government	47%	50%	50%
Local Government	48%	50%	50%
Environmental Laws/Regs	49%	45%	47%
Labor Quality	25%	14%	17%
Labor Availability	32%	11%	20%

Source: California Migration Study

Figure 2.3

Causes of Industry Migration

What are the most important factors in not selecting California?



DIRECT BUSINESS COSTS
(66% Mentioned)

Factors	% Total Respondents Expansions	Relocations	Overall
Labor	60%	54%	58%
Real Estate	42%	46%	42%
Energy	19%	22%	20%
Materials	7%	7%	7%

Source: California Migration Study

6. Air quality regulations were generally ranked behind workers compensation, taxes, and liability law reform as business climate problem areas or locational determinants by any of the studies which asked respondents to rank issues.

7. The studies recorded support for maintaining a good environment and good air quality even when concerns with air quality and environmental regulation were identified.

2.3 Two Other California Business Climate Studies

How specific were the business climate concerns expressed in the six studies reviewed above specific to the 1990-1993 economic downturn? Answering this question will provide help in Chapter 7 in assessing the role of business climate concerns generally and air quality regulations specifically on the significant job losses in California during that period.

Two studies - one conducted before the recession began and one conducted after the recession ended - were reviewed to provide a perspective on the six 1990-1993 studies.

2.3.1 California Economic Development Corporation - Vision 2010

The California Economic Development Corporation is a public/private sector partnership to assist the State's effort to promote job creation through the expansion of major industrial and commercial investment in California.

Vision: California 2010 was prepared in response to the request of Governor George Deukmejian and published in March 1988. Thus, Vision 2010 presents views on the California economy prepared before the 1990-1993 economic downtown.

2.2.7 Summary of Six Business Climate Studies Conducted 1991-1993

The six studies produced relatively similar evidence on the role of air quality regulations in business location decisions in California between 1990 and 1993.

1. All of the studies relied on testimony of business executives as the major source of evidence. The principal methodology of most studies was to conduct interviews and hold forums to receive testimony.

2. There was no quantitative evidence presented on the impact of air quality regulations on the California economy. Even the SCAQMD study which took testimony primarily on the issue of whether air quality regulations hurt the economy reported no quantitative findings.

3. The studies cited a long list of reasons for California's lagging economy during the 1990-1993 period. The studies identified problems with California's business climate as one set of explanatory factors along with the national recession, defense spending cutbacks, and a severe construction downturn.

4. The studies recorded testimony on a long list of business climate problem areas including workers compensation, permitting, tax policy, litigation climate, and environmental regulations.

5. Air quality regulations were identified specifically as a problem area in some studies. These studies primarily recorded testimony from individual business owners about their experience with and perception of the impact of air quality regulations on business climate and location decisions.

Whenever air quality regulations were examined specifically, two areas of concern were identified. Business executives expressed concern both with the direct compliance costs of air quality regulations and with the time and uncertainty costs involved in the permitting/regulatory process.

only if Californians cooperate in determining environmental management strategies. The current process has given rise to unrealistic standards that threaten our ability to sustain the economic growth needed to fund environmental quality (California Economic Development Corporation, 1988).

The Vision 2010 recommended environmental strategies were:

- Review current priorities
- Design, develop and pursue integrated environmental management strategies
- Use market incentives to complement regulatory mechanisms
- Increase analytical capability in risk assessment and risk management
- Cooperate rather than confront
- Hasten the adoption of alternative fuels
- Improve transportation system management
- Increase the private sector role in environmental management

Of the six reports described above, the Vision 2010 report is most similar to the California Business Roundtable - BCG analysis. The Vision 2010 report stressed investment in people and infrastructure as the keys to achieving economic prosperity.

The strategy to fulfill the Achievable Vision must be based on wise investment - investment in people to maintain our competitive edge, investment in economic infrastructure to lay the foundation for environmentally balanced growth and on a fiscal and legal environment that promotes private wealth creation (California Economic Development Corporation, 1988).

The Vision 2010 report identified three major areas for policy development:

- Human Capital
- Economic Infrastructure
- Fiscal and Legal Environment

Under the heading, Fiscal and Legal Environment, Vision 2010 listed:

Taxing and Spending
Environmental Regulations
The Legal environment for Collaboration
Civil Liability

Under the heading, Leading Environmental Regulations, there was a discussion of regulatory concerns and general principles for action.

Despite the importance of a clean and safe environment, it is not easy to achieve. The strategies recommended (below) assure continued environmental progress, but are possible

Question: Effect on your business in California?

Percent Responding Bad Effect				
	1994	1993	1992	1991
Liability Laws	86%	90%	89%	84%
Health Care Costs	82%	89%	92%	85%
State Business Taxes	81%	86%	83%	85%
Permitting Process	63%	67%	67%	
Workers Compensation	80%	92%	90%	86%

The top four concerns show remarkably consistent ratings over the 1991-1994 period with very little drop after a year of economic recovery.

2.3.3 Comparison of Business Climate Studies

The review of the Vision 2010 report and 1994 California Business Roundtable survey provide perspective on the six studies reviewed above.

1. There are long standing concerns in all of the five major categories of locational determinants listed on Figure 1. Both the 1988 and 1994 studies identified concerns about education, infrastructure, and quality of life issues as well as business climate issues.

2. A wide variety of business climate issues were identified by business executives both when the economy was growing and when it was declining. As a result, the business climate issues are clearly not just associated with the 1990-1993 recession in California.

2.3.2 1994 California Business Roundtable Survey

In November 1994 the California Business Roundtable published their 1994 survey of business leaders and voters.

By November 1994 the California economy had been in recovery for more than a year. Retail sales were rising, home sales and new construction were up, income was growing, and the California Department of Finance had announced that job levels in March 1994 were 220,000 higher than previously reported and that job growth would be at least 150,000 in 1994. Moreover consumer confidence had made substantial gains indicating that the improved state of the economy was recognized by the general public.

In light of the improved economic conditions in California it is interesting to review two questions in the 1994 Business Roundtable Survey.

Question: How would you rate business conditions today?

Negative Ratings				
	1994	**1993**	**1992**	**1991**
In the nation	19%	51%	66%	60%
In the state	76%	94%	93%	70%

Two points stand out. First, in late 1993 when the nation had added more than three million jobs in the previous twelve months, more than half of the respondents rated the nation's business conditions as negative.

Second, in late 1994 more than 75% of respondents thought California's business conditions were negative. This is a higher negative rating than in 1991 when both the nation and state were in a recession.

nearly half of those managers who name environmental regulations as a serious location factor cannot identify a single example where those factors actually made a difference in a location decision.

Even when respondents identify a variable as being a factor in a given location decision, it might not be a *deciding* factor. As an example, most people agree that business climate has some bearing on industrial location. Yet Skoro (1988) finds that business climate indices are poor predictors of an area's economic performance and that the minimal predictive power they do have can be explained by their inclusion of past economic performance as one variable. As one form of validity testing, Stafford (1985) asks his interviewees to discuss their locational process broadly first, before asking them to rank specific variables. This allows the interviewer to check for consistency between the rankings and the undirected comments.

Some of the most important findings from survey studies have to do with the process that firms use in making location decisions. Stafford (1985) finds that environmental variables tend to be considered early in a search, and that when they are considered, air pollution controls are most likely to affect choices between states. This makes sense, in that most variation in regulatory requirements occurs between states rather than at other levels of geography. Schmenner (1979) finds that the vast majority of firm moves are restricted to within 20 miles of the original site in order to maintain continuity in the labor force. Given that most air pollution regulations cover much larger areas than this, we might suspect that air regulations are unlikely to affect large numbers of relocations. Stafford also finds that environmental controls do not affect the size of the search area, the number of sites examined, or the distance over which firms move. In short, there is not yet any evidence that environmental regulations fundamentally change the way in which firm managers make their location decisions.

Among fortune 500 firms, Schmenner (1982) found that 17% of managers opening new plants and eight percent of managers that moved plants identified the ability to acquire necessary environmental permits as an absolute requirement for the region of choice. Despite this, the ability to obtain permits was rarely an obstacle, with only three of 158 managers

3. The negative ratings of business executives in the Business Roundtable Survey were high even when the economy was growing. This might be due to a multi-year lag before people's perceptions adjust to the improving economic conditions. These findings suggest great caution in using the business climate studies and surveys as an explanation of trends in the economy in general and in linking air quality regulations to trends in jobs and income.

2.4 Other Business Surveys

In addition to the above eight recent studies related to the California economy, a number of other surveys of business climate and location issues have been consulted. The business survey research methodology is very flexible, and can prove invaluable by helping investigators to:

- discriminate between different types of location decision (e.g., differentiating startups from new plants that have been relocated from other areas).
- discern distinct stages in the decision process (e.g., by identifying which variables affect the selection of a region and differentiating those from variables that affect the selection of sites within a region).
- elicit manager preferences among alternative policy instruments.
- obtain very specific information not available from aggregate data sources (e.g., we might ask managers about strategic considerations unique to their industry that affect their locational behavior).

Despite these beneficial uses, drawing conclusions from survey data is usually very difficult. Perceptions of individual managers may be far removed from the real decision-making process. It may be, for instance, that managers in the establishments being opened or closed interpret the firm's location choices differently than administrators holding positions in the corporate headquarters. Also, there is always the possibility that managers will intentionally manipulate their responses in an effort to influence the survey results, especially when surveys are conducted in a politically-charged atmosphere. As an example, Stafford (1985) finds that

ranked environmental laws as having some importance to their move. On the other hand, the accounting firm of Coopers and Lybrand conducted a national survey of managers involved in plant closings between 1975 and 1982 and found that only two percent of the respondents identified environmental controls among their top three reasons for closure (Coopers and Lybrand, 1986). In part, these results perhaps reflect real differences between California and the rest of the U. S. Some of the difference may be due to the time span of each study. Others may be due to the definitional differences in the questions asked. In light of the large difference in the U. S. versus California results, one needs to be careful in comparing the two studies.

2.5 Summary

The comparatively poor performance of the California economy in early 1990s led to a number of studies of why the California economy was lagging. Many of these studies focused on a set of issues that became known as business climate issues including workers compensation, environmental regulations, permitting policies, taxes, and litigation reform. A review of major business climate studies indicates long standing concerns about education, infrastructure, quality of life, and business climate issues. There were concerns with business costs and the permitting process in general but there were no specific findings on air quality regulations.

surveyed listing environmental considerations as a factor in their own siting decisions. Among 38 plant managers that had relocated recently, only one listed regulatory factors as important.

Stafford (1979, 1985) notes that California gained a reputation for stifling regulation, yet led the country in new manufacturing job growth in those same years—even in heavily regulated sectors. Stafford also finds that 68% of managers surveyed cannot provide a single example in which environmental variables were a significant factor in a real location decision. Surprisingly, this includes 42% of those managers who indicate environmental factors are very important in their location decisions (Stafford, 1985). Part of this may be explained by Stafford's observation that few plant managers perceive large geographical differences in capital costs associated with environmental controls. Indeed, his respondents show far greater concern over possible delays and the number of permits required than about either spatial variation in costs or the uncertainty of those costs.

Fairbank, et al. (1990) find that 83% of local business leaders surveyed believe air regulations in the Los Angeles Basin make it difficult to expand manufacturing there. Respondents rank air regulations second only to high housing prices among factors discouraging local economic expansion. Yet, this result needs to be considered carefully because their study does not include other key factors usually identified as major business obstacles, such as wages, workers' compensation, or local unionization rates. 85% of the business people surveyed by Fairbank, et al. also believe that air regulations will be a factor in future company decisions and 28% surveyed believe regulations will be a dominant factor in such decisions. Unfortunately, the authors do not differentiate location decisions from other types of business decisions. A major weakness of the survey is that it does not include results from other areas for comparison, since displeasure with local regulations need not deter expansions unless better alternative sites are available.

Surveying firms that either moved facilities out of California or chose to expand out-of-state between 1980 and 1992, Bules and Associates (1992) utility sponsored study discussed above found that 62% of those managers interviewed selected business climate issues as being important in their move. Within that subset of managers, 47% (29% of all managers)

Chapter 3

LITERATURE SURVEY

There exists substantial academic and public policy research that has attempted to determine the factors that affect the industrial location decisions of firms. The goals in this review are: 1) to identify major issues associated with measuring the locational impacts of regulations; 2) to summarize what we know; and, 3) to examine critically how this project might best proceed to improve our state of knowledge.

The links between the location of economic activity and environmental issues run both ways. On the one hand, as economic activity generates pollution, the areas with the most production activity will also have the greatest amount of pollution. On the other hand, as the environmental regulations are imposed to combat pollution in specific areas, firms will try to move out of these areas to those with lower regulations. The first issue is viewed as primarily an engineering question though economists have considered both questions. This review focuses primarily on the second question, namely the effect regulation has on firm location.

The location question in economics is treated in an optimal choice framework: there may be a number of possible sites for location of a plant or firm each offering various characteristics (including environmental regulations) , and a firm picks the best location where "best" is usually the one that leads to "profit-maximizing" choice. Environmental regulations affect the choice by affecting the production costs. This approach is different from the survey approach where direct questions are asked about the locational preferences of businesses. The next chapter critically reviews business climate studies relevant for California.

Literature on non-environmental location is also referenced when it provides insights applicable to environmental policy. In some instances, authors have not differentiated clearly between air pollution regulations and other types of pollution controls. In these cases, the discussion focuses on areas where there might be confusion.

3. **The Time Frame Of Analysis.** Air pollution regulations have changed over time, tending to become more uniform across states when federal legislation was passed in the early 1970s. Consequently, studies made in the late 1970s and early 1980s should identify a stronger impact of location than later studies (Bartik, 1988; McConnell and Schwab, 1992; Pashigian, 1985). However, the post-1980s attempts at reducing regulations may have introduced more disparity among states.

4. **The Subset Of Industries Included**. The vast majority of statistical research has pertained to manufacturing. There has been a serious underrepresentation of trade and services firms of all types (Wasylenko and McGuire, 1985).

5. **The Size Of The Firms Included.** Most analysts have conducted their research on large and multi-plant firms. As Schmenner (1982) points out, conclusions obtained from large firms may not apply to their small firm counterparts, since the latter tend to rely more on top-down decision making than on the teams of specialists often found in larger firms. Small firms are less likely to search outside their immediate region for a new site location. Consequently, pollution controls are less likely to result in small firm moves than for large firms. On the other hand, small firms are much more likely to open and close than large firms. There is very little research, with the exception of Gray (1994), estimating how small firm openings and closings are affected by pollution controls.

6. **Data Sources Used.** One of the greatest constraints on statistical location research has been the small number of accurate and timely data sources for measuring location shifts at the establishment level. Given the difficulty in finding reliable data for a wide variety of industries, researchers have usually been forced to take incomplete censuses of restricted groups, rather than taking random samples of wide populations. Likewise, they have had to piece together data from different sources, raising the possibility of inconsistent definitions and collection practices. The primary data sources used have been the Dun and Bradstreet locator files and the US Census of Manufactures, and industrial registries maintained by trade

This review is organized as follows. First, a basic summary of the methods used and methodological issues are presented that occur across all different types of studies. Second, the results obtained from prior research on state and local tax policy are reviewed, an area closely related to regulatory impacts that has been the subject of far more research than environmental regulation. Finally, the studies of environmental regulation specifically are examined.

3.1 General Methodology Issues

A review of the literature shows that results depend heavily on the methodology used and that one needs to be very precise about what one is studying. Different variables affect different kinds of locations decision in different kinds of firms at different times. Some of the key issues that need to be considered are:

1. **The Kind Of Location Decision.** Goode (1989) and Walker and Greenstreet (1990), for instance, argue that the location of startups is determined by different factors rather than expansions and relocations. To date, most investigators have centered their research on plant openings and closings, with far less analysis of how regulation might affect in situ expansions and contractions. This is important, because most firms will adjust capacity at an existing site before opening or closing new facilities.

2. **Stage Of The Decision Process.** Most firms begin their geographical search over a wide area and gradually narrow it down to a specific site (Stafford, 1980; Schmenner, 1982; Schmenner, et al., 1987). Researchers agree that different variables are important at different stages in this decision-making process (Stafford, 1974; Schmenner, 1982).

taxes and fiscal spending affect location decisions between choices of localities within a single metropolitan area even if they are unimportant between regions or states (Erickson and Wasylenko, 1980; Wasylenko, 1980a, 1980b). This conclusion probably does not apply to pollution control because the latter varies much less than taxes at this intrametropolitan scale. Several authors have also found that effects of taxation on location vary between industries. Newman (1983), for instance, argues that changes in corporate tax rates affect growth rates of capital-intensive industries more seriously than other industries. Similarly, Wasylenko and McGuire (1985) find that personal income tax rates, levels of tax effort, and education spending affect employment growth rates for some industries and not for others.

3.3 From Taxes to Environmental Regulation

In the past decade, these tax studies have been extended to examine whether environmental regulations affect firm location decisions. Most empirical studies of the impact of environmental regulation on location have been either cross-sectional statistical analysis using regression or logit methods or survey-based. These approaches have different strengths, weaknesses and issues associated with them. Each is considered in turn, beginning with a brief discussion of methodological issues, then presenting a summary of existing studies. The survey based studies are analyzed in the next chapter.

3.4 Cross-Sectional Studies

Several analysts have used cross-sectional studies to test for statistical relationships between location decisions and environmental regulations. Conditional logit analysis has been used most often, with researchers estimating how local regulatory characteristics influence the probability that a firm will locate at a particular site, *given the knowledge that it will choose a site somewhere*. This assumes a decision-making process wherein firm managers first decide whether or not to open or close a plant, then proceed to consider the merits of particular regions or sites (Schmenner, 1982). Usually, the dependent variables represent some change

associations. Gray (1994) uses Census of Manufacturing database. Each of these have problems unique to them that can affect research results (Armington and Odle, 1982; Howland, 1988).

3.2 Research on State and Local Taxes

Until very recently, there has been little empirical evidence on the question of how spatial differences in environmental regulations affect business location. Historically, research tended to focus on the role played by state and local taxes. Tiebout (1956) argued that, all else being equal, mobile individuals choose those locations that best reflect their preferences for public spending and taxes. He recognized that taxes and public spending affect the locational preferences of individuals in ways not easily captured in a strict numerical accounting of benefits and costs. In principle, we can add spatial differences in environmental regulation to taxes and public spending as one more aspect of the business climate with the potential to affect industrial location decisions. Prior reviews of the locational impacts of local taxes on location may be found in Due (1961), Oakland (1978), Wasylenko (1980), and Newman and Sullivan (1988). Walker and Greenstreet (1990) review briefly studies of how government-sponsored incentive programs affect business location.

In the 1970s, empirical research took a major step forward with McFadden's application of conditional Logit analysis to spatial choice behavior (McFadden, 1974, 1978). The method provides a probability of location for a firm based on the values of a set of specified characteristics. For the first time, this enabled researchers to quantify how the probability of a firm locating in a given location would be affected by regional and site-specific characteristics (Carlton, 1979). In most instances, these statistical studies found that taxes and business climate variables have little, if any, effect on location (Schmenner, 1978, 1982; Carlton, 1983). The argument was usually that taxes were too small a part of overall costs to have an impact (Due, 1961). In the past decade, there has been some slight moderation in this view, as researchers ask more finely tuned questions, using more careful econometric specifications (Newman and Sullivan, 1988; Bartik 1992). A growing number of authors now believe that

new plant openings than do control costs. Generally speaking, firms in nonattainment areas are subject to stricter controls than firms in attainment areas. A possible drawback of the measure is that the analyst must determine which pollutant is most critical to location, because most areas have attainment status for some pollutants and not for others. Also, the mix of control measures that apply to nonattainment firms has not been constant over time, so results may vary with the time period chosen (as noted above).

Specific Standards: Given the difficulties associated with using control costs and attainment status as measures of environmental stringency, a few authors have attempted to look at how specific regulations affect more narrowly defined industries. McConnell and Schwab (1990) examine the impact of limits on volatile organic compounds (VOCs) in automobile manufacture. Bartik (1988) uses controls on industrial boilers, a single rule that applies to a large number of establishments in different industries. The advantages of using individual rules are that it tightens the logical link between regulations and the industries they affect and allows for more careful specification to account for unique industry characteristics. Bartik, for example, adjusts for local fuel mix. Because different fuels cause different levels of pollution, areas burning dirty fuels face stricter effective standards than areas burning equal amounts of clean fuels. The main disadvantage of using specific rules is that it may cause us to miss cumulative impacts on firms or establishments that are subject to many different regulations.

3.4.2 Control Variables

In order to measure the influence of environmental regulations on location accurately, it is necessary to control for other important spatial, temporal, and industrial factors. Three categories of independent variables appeared most often in studies reviewed here:

in location such as a plant opening or closing. Independent variables most often measure initial levels of other regional characteristics. Implicitly, this assumes that plant openings and closings occur in response to initial disequilibrium in the market. An excellent review of specification issues common to much of this research can be found in Newman and Sullivan (1988). Most of this research has focused on branch plant openings; but no studies of plant closings were found that included environmental factors.

There are two especially important methodological issues that affect these cross-sectional studies:

3.4.1 The Measures Of Regulatory Stringency Used

In order to demonstrate statistically that a significant relationship exists between regulation and location, researchers must use a measure of regulatory stringency that both exhibits significant spatial variation and can logically be expected to influence location. Researchers have used three types of environmental regulatory variables most often:

Control costs: Control costs, for instance, may be correlated with industry mix, meaning that any significant results obtained may be caused by the composition of the local industrial base more than the characteristics of the regulatory environment (Carlton, 1983). Also, industries may have low control costs precisely because regulations have dissuaded new firms from opening (Levinson, 1994; Crandall, 1993).

Attainment status: All areas in the United States (SMSAs and larger) are categorized as either attaining or not attaining federal standards for major pollutants. McConnell and Schwab (1992) also used the degree of nonattainment, measured as whether a site was out of compliance for multiple recording periods and whether it had to seek an extension for compliance. One positive aspect of using attainment status as a measure of regulatory stringency is that it appears to provide a closer link between regulation and

3.4.3 Empirical Results

Overall, the cross-sectional research gives little support for the view that environmental regulations have affected either the process or the results of locational decisions. A recent review of the literature (Jaffe, et al. 1995) draws similar conclusions. Using a logit analysis with four different measures of regulatory stringency, Bartik (1988) finds that high local taxes lower the probability of locating branch plants in an area, but that stricter environmental regulations do not. Friedman, et al. (1992) find that the probability of European and Japanese firms locating branch plants among different states in the US is unaffected by capital spending on pollution control (measured relative to gross state product). However, when the firms are divided by nationality, Japanese firms are less likely to locate in high control spending areas than firms from other countries. The authors attribute this to differences in industry mix between the Japanese and European firms represented.

McConnell and Schwab (1990) focus on a single set of industries involved in automobile manufacturing, using a county-level logit analysis with several different measures of regulatory stringency. They find no impact on the probability of locating new branch plants in ozone nonattainment areas. However, when the *degree* of nonattainment is factored in, the probability of locating a branch plant decreases for a handful of the most polluted areas. The authors find that most spending variables are insignificant. An exception is per employee state government spending on air pollution control, which *increases* the probability of locating a branch plant. Taken together, these results suggest that firms may actually be avoiding pollution and/or that they may value strong pollution control efforts. McConnell and Schwab do not discuss this possibility in their findings.

Levinson (1994) uses seven different measures of environmental stringency to investigate new startup and branch plant openings between 1982 and 1987. He finds that one standard deviation decrease in environmental regulatory stringency leads to, at most, a 1.7% change in the probability that a new plant will locate in a given state. To place this in perspective, this would be roughly equivalent to the average state raising its control costs by 60%, resulting in 113 new jobs foregone over five years. Clearly, this is a very small response

- **Market Characteristic Variables** designed to account for differences in local features such as demand patterns or agglomeration economies. Commonly used variables include density of the local road network, population size and density, and port access. Several studies include land area to test the "dart board" theory that larger regions provide greater opportunities for location. McConnell and Schwab (1990) include a gravity-style demand variable that sums distance-weighted income over all other states.

- **Labor Market Variables.** Most common among these are workforce size, local unemployment and wage rates, productivity figures, education levels, and unionization rates. Several studies also identify areas having right-to-work laws.

- **Tax And Fiscal Variables** that might affect the local business climate. These typically include aggregate public spending per capita, as well as spending on education and welfare in the region. Friedman, et al. (1992) include a measure of local promotional spending on economic development. Tax variables most often included are local property and corporate tax rates. Friedman, et. al. include a measure of tax effort and a dummy variable indicating whether or not an area uses a unitary corporate income tax.

In addition to the variables listed above, several authors have included regional dummy variables to account for unobserved, spatially-dependent characteristics. Several factors have not been controlled for as well as they might be, especially industry mix and business cycle activity. Dunne, et al. (1988) point out that entry and exit rates for firms often vary significantly among four digit sub-industries of the same major industry group. None of the studies reviewed here included any measure of business cycle activity, even though the typical study period spanned between five and fifteen years in length. Also, there has been little consideration of possible lag structures. Implicitly, this assumes that firms may wait indefinitely before relocating in response to market disequilibrium.

regulators responded to this, reducing enforcement at plants that faced tougher competitive pressures and were more likely to close).

Empirical research has tended to support the argument made by Bluestone and Harrison (1982) that plant closings are determined first and foremost by corporate-wide strategic factors. Erickson (1980) and Henderson (1980) conclude that growth rates in the parent industry are important to determining plant closings. The results of Healey (1982) support a more subtle argument—that the single most important reason for closures has to do with the firm's need to consolidate operations among fewer branches. This need for consolidation is determined by the firm's overall investment strategies, only part of which relates to profit or growth rates. In other words, even high profit firms may face the need to consolidate branches.

Despite the apparent dominance of broad strategic factors in plant closing decisions, one still might expect that the choice of *which* plants to close is affected by localized factors, including local regulatory policies. Much plant closing research has focused on the role of plant age and size, especially in the United Kingdom. Evidence on the role of plant age is mixed. Several authors argue that young plants are more prone to closure (Henderson, 1980; Collins, 1972; Gudgin, 1978). Sant (1974) finds that very young plants are initially less likely to be closed, but that this probability of closure increases until the plant is between five and eight years old. Healey (1982) and O'Farrell (1976) find no significant relationship between closures and plant age. There is somewhat more agreement regarding the role of plant size, with most authors agreeing that small plants are more prone to closure than are large ones (O'Farrell, 1976; Henderson, 1980; Healey, 1982). Loasby (1967) suggests that it is the size of the branch plant relative to its parent that is most important.

It is not obvious how air pollution control regulations affect either plant age or size. Healy (1979) suggests that air regulations favor small plants, because most regulations, especially new source reviews, tend to exempt small operators. On the other hand, Pashigian (1984) argues that pollution controls favor larger plants by raising scale economies. He notes that, in manufacturing industries with high control costs, the mean number of plants has actually

to a very large stimulus. Levinson also finds no strong evidence that heavily polluting industries are more sensitive to environmental regulations than clean industries.

Gray (1994) uses six Census of Manufacturing data sets to look at the birth of new firms. He examines several measures of regulation: environmental spending by the state and manufacturing industries, political support for regulation, air pollution regulatory enforcement activity, and qualitative measures of state regulations. He finds negative impacts for most of the measures but, interestingly enough, positive impacts for both the spending variables. Also these effects are stronger in 1960s than in 1970s or 1980s. Bartik (1989) detected a significant negative impact of state-level environmental regulation on the start-up rate of small businesses, but the effect was substantially small. A change of one standard deviation in the stringency variable (the Conservation Foundation rating) yielded a 0.01 standard deviation change in the state start-up rate of small businesses.

In contrast to plant openings, there are only a few cross-sectional analyses of environmental regulations and plant closings or other regional. Duffy-Deno (1992) estimates employment and earnings changes in manufacturing associated with both air pollution control and total pollution control spending. He finds that a ten percent increase in air pollution control costs is associated with a .65 percent decrease in manufacturing employment in Sunbelt states and a .45 percent decrease in Frostbelt states. In every case, these impacts are an order of magnitude below those for tax variables. He finds no statistically significant impact of air pollution controls on earnings, and no impact on either earnings or employment for total pollution control spending. While important for understanding behavior for manufacturing as a whole, these results tell us little about either in situ contractions or plant closings, because we do not know how these impacts are distributed among establishments or industries within manufacturing.

A study by Deily and Gray (1991) looked at the integrated steel mills around the country in 1976 and examined the air pollution enforcement activity they faced. They found that plants which tended to face more enforcement were significantly more likely to close (and that

manufacturing firms). Although plant managers frequently cite environmental regulations as a problem, the evidence does not show up in most studies. It also appears that many impacts of regulations are from non-cost factors such as impacts on flexibility and delays in production—factors that have been studied very little. Nonetheless, it cannot be concluded that environmental regulations are unimportant until one asks much more refined questions.

Based on the current state of research, there is little evidence that environmental regulations have played a major role in industrial location, especially for manufacturing as a whole. Also, past researchers have tended to ask the very broadest of questions, namely "do air pollution controls affect industrial location?". While such questions have merit and provide information on the broad role regulatory policy may play in industrial location, investigators of state and local tax policy have learned that seemingly reasonable answers to such broad questions may not hold true when we examine more narrowly defined impacts in specific industries. Clearly, environmental regulations will affect some types of location decisions and not others; likewise, some facilities will be affected and not others.

We are at a point where we need to begin asking more refined questions. Most important, we must investigate much more carefully how environmental regulations affect the competitiveness of individual firms and how those competitive impacts interact with firm location strategies. The survey undertaken for this project adresses some of these issues (Chs. 5 and 6) .

declined, even though those same industries experienced growth in value added that was above the norm for manufacturing as a whole. Moreover, in high control cost industries, small firms have lost market share. Both of these trends are reversals of pre-regulatory years. Unfortunately, he lumps all pollution control spending together. Stafford (1985) argues that regulations have no impact on the size of new facilities built. Moreover, among managers who believed regulations were very important, nearly identical numbers supported the view that regulations favored larger facilities as did the opposite view.

Both Schmenner (1979) and Stafford (1991) identify inflexibility at the plant level and low technological sophistication as important reasons for plant closures. However, as Robinson (1993) points out, there are different types of flexibility, and these are likely to be affected by regulation in complex ways that we understand incompletely. There is some evidence that regulations may affect technological change. Examining water quality controls, Braden et al. (1987) conclude that firms may wait to adopt new technologies if their price is expected to decline over time. They also cite several unpublished reports that find new source standards discourage turnover in capital by forcing firms to meet stricter standards on new plant and equipment (Croke and Swartzman, n.d.; Smith and Basala, n.d.). But there are other reasons for plant closures as well. Obsolescence, lack of product demand or the end of a product cycle are some examples of the economic causes for plant shut-downs.

3.5 Summary

The results of this review suggest that environmental regulations are one of many factors that firms consider when making location choices, especially choices between states. However, there is little evidence that regulations have become a truly important location factor for most industries. Most studies seem to show some effect of regulation on plant location but the effect is generally small (especially when compared to other factors such as wages, unionization, or product demand). Some studies find no impact. Direct measures of regulation (attainment status, enforcement activity, or indices of stringency) tend to show more of a negative impact than do measures of regulatory spending (either by state regulators or by

Chapter 4

THE COST OF CALIFORNIA AIR QUALITY CONTROL REGULATIONS

Competitiveness of a region may be defined in terms of the relative size of its industry in national or international markets. Competitiveness in turn is influenced by business costs of which regulatory cost is one element, as shown in Figure 2.1. The costs of compliance with air quality regulations can be expected to play a role in the growth of an industry subject to such regulations. It is not, however, the absolute cost of compliance but rather the relative differences in the cost of regulation across geographic regions that are likely to be important in location and expansion decisions of firms.

In order to estimate the costs of California air quality regulations this project adopted a two-pronged strategy: an examination of the cost data collected through a direct survey of California businesses subject to air quality regulations and analysis of available secondary source data. The secondary source cost data are summarized below. These include data collected from Department of Commerce surveys of pollution abatement control costs, South Coast Air Quality Management District (SCAQMD) data on estimated costs before regulations are issued, and the Environmental Business Journal data on control equipment costs. The original survey cost data, collected by IEES for this project, are reported in the next two chapters. Chapter 6 also provides an evaluation of the accuracy and significance of the cost data discussed in Chapters 4, 5 and 6 for business location decisions.

4.1 US Department of Commerce Data

Each year the Industry Division of the Bureau of the Census conducts a survey of pollution abatement costs and expenditures. The survey had been conducted annually since 1973 with the latest report covering data for 1992.

Table 4.1

California and United States

AIR POLLUTION ABATEMENT COSTS 1988-1992

($Millions)

		Capital Costs	Operating Costs	Total Costs
U.S.	1992	$4,403.1	$5,395.0	$9,798.1
	1991	3,706.3	4,955.6	8,661.9
	1990	2,562.0	5,010.9	7,572.9
	1989	1,819.0	4,694.2	6,513.2
	1988	1,524.1	4,466.5	5,990.6
California	1992	$418.7	$490.3	$909.0
	1991	443.7	616.4	1,060.1
	1990	286.6	673.7	960.3
	1989	141.0	453.3	594.3
	1988	243.2	471.9	715.1
California as Share of U.S.	1992	9.5%	9.1%	9.3%
	1991	12.0%	12.4%	12.2%
	1990	11.2%	13.4%	12.7%
	1989	7.8%	9.7%	9.1%
	1988	16.0%	10.6%	11.9%
Average	1988-92	10.9%	11.0%	11.0%

Source: Pollution Abatement Costs and Expenditures-1991 and 1992, U.S. Department of Commerce

Data are collected by state and for each two digit SIC. Data are collected for both capital and operating costs for pollution abatement related to air, water, and solid waste. These data refer only to the manufacturing sector of the economy. Air quality regulations do apply to some non-manufacturing industries but in the absence of any independent data for these industries all the conclusions discussed here are applicable only to the manufcturing sector.

4.1.1 Air Pollution Abatement Costs in the U.S. and California

Capital, operating and total air pollution abatement costs for California and the United States are summarized on Table 4.1 for the years 1988-1992. For the five year period California averaged

10.9% of U.S. capital costs
11.0% of U.S. operating costs
11.0% of U.S. total costs on air pollution abatement

The state's share of total costs was highest in 1990 (12.7%) and declined in 1991 and again in 1992. During this period California averaged between 10% and 12% of national jobs, population, and income. As a result, the state's share of total national air pollution abatement expenditures was similar to California's share of national economic activity.

4.1.3 Comparison Among States

Air pollution abatement costs are compared for selected states on Table 4.3. Air pollution abatement costs ranged from 0.06% of sales in Massachusetts in 1991 to 0.33% of sales in Texas. Three states - Arizona, Texas, and Utah - had higher ratios than California.

Operating and capital costs as a share of sales ranged from 0.08% in Massachusetts to 0.47% of sales in Texas. Arizona, Texas and Utah had higher ratios than California.

Air pollution abatement capital costs ranged from 0.74% of total capital expenditures in Massachusetts to 3.40% in Utah. Georgia, Texas, and Utah had higher ratios than California.

4.1.4 Air Pollution Abatement Costs by Industry

Air pollution abatement costs by industry are shown on Table 4.4 for California and the nation.

Air pollution abatement expenditures in the nation are concentrated in four industries in the manufacturing sector. The largest contributors to total costs in 1991 were

Petroleum Products	28.4%
Chemicals	19.6%
Primary Metal Products	16.3%
Paper	10.2%
Four Industry Total	74.5%

and the four industries accounted for nearly three-fourths of all national pollution abatement expenditures - $6.4 of the $8.7 billion in total expenditures in the manufacturing sector.

4.1.2 Costs As a Share of Sales

Data on total shipments (sales) and capital expenditure from the Annual Survey of Manufactures conducted by the U.S. Department of Commerce were used to express the pollution abatement expenditures as a percent of sales and capital outlays. Data on value added are also tabulated. The results using shipments or value added are similar. The latest Annual Survey of Manufactures was available for 1991 and these data were used with the 1991 Pollution Abatement Costs and Expenditures report. The following observations can be made with regard to this data:

Operating costs for pollution abatement averaged 0.2% of sales for 1988-1991 in California as shown on Table 4.2. In each year operating costs were far less than 1% of the value of sales ranging from 0.16% in 1989 to 0.23% in 1990.

In the nation operating costs for pollution abatement averaged 0.17% for the 1988-1991 period. Thus pollution abatement operating costs in California were 17.6% higher as a share of total sales than in the nation.

Operating and capital costs for air pollution abatement averaged 0.29% of sales in California for 1988-1991. The high share was 0.37% in 1991 and the low share was 0.21% in 1989.

In the nation, operating and capital costs averaged 0.26% of sales for the comparable period. Total costs in California were 11.2% higher as a share of sales when compared with the nation.

Capital expenditures on air pollution abatement equipment averaged 3.09% of total capital expenditures in California for the 1988-1991 period. The comparable national average was 2.54%. The California ratio was 21.6% above the national average for this time period.

These three industries accounted for a very small share of California's total manufacturing activity in 1991 as shown on Table 4.6. Petroleum Products; Stone, Clay and Glass; and Primary Metal Products accounted for 5.6% of California's manufacturing jobs in 1991 and 11.0% of total manufacturing shipments.

All other manufacturing industries in California have air pollution abatement operating costs of 0.2% of sales or less in 1991.

Operating and capital costs for air pollution abatement averaged 0.29% of sales in California's manufacturing sector in 1991. This ratio was exceeded in Petroleum Products, and Stone, Clay and Glass and equaled in Paper, Chemicals, and Primary Metal Industries.

These five industries accounted for 10.9% of California's manufacturing jobs in 1991 and 18.7% of the state's manufacturing shipments.

Thus the industries where air pollution abatement costs in California were relatively high accounted for a small share of manufacturing activity. Moreover, in three of these industries - Paper, Chemicals, and Primary Metal Products - costs in California represented a smaller share of sales than in the nation.

All of the difference between the state and national air pollution abatement cost ratios shown on Table 4.2 is accounted for by one industry - Petroleum Products. California has a higher share of manufacturing activity in Petroleum Products- see the discussion of Table 4.8 below - and California's air pollution costs for Petroleum Products are double the national average.

In California one industry - Petroleum Products- accounted for nearly two-thirds of total pollution abatement costs in the manufacturing sector. The next largest industry was Transportation Equipment which accounted for just 7.6% of total costs.

Air pollution costs as a share of sales are compared on Table 4.5 for California and the United States. In nine industries,

Food Products
Lumber & Wood Products
Paper
Chemicals
Rubber & Plastic Products
Primary Metal Products
Industrial Machinery
Instruments
Miscellaneous Manufacturing

total operating and capital costs are a higher share of sales in the nation than in the state. In two industries - Fabricated Metal Products and Electrical Machinery - the ratios are similar. In four industries

Printing & Publishing
Petroleum Products
Stone, Clay and Glass
Transportation Equipment

the ratio is higher in California.

Operating costs for air pollution abatement averaged 0.2% of sales in California in the manufacturing sector in 1991. This ratio was exceeded in only three industries.

Petroleum Products	2.02%
Stone, Clay and Glass	0.45%
Primary Metal Products	0.23%

4.1.5 Comparison With Texas

California's air pollution abatement costs by industry are compared to those in Texas on Table 4.7. Texas was selected as a comparison statement because 1) Texas has a large industrial economy, 2) Texas has a large petroleum industry, and 3) Texas is often mentioned as a state whose economy has been gaining at California's expense.

Air pollution abatement costs as a share of sales are below California's average in each of the state's large technology industries - SICs 35, 36, 37 and 38. In SIC 35 (including computers) and SIC 38 (instruments) air pollution abatement costs represent under 0.05% of sales in both California and Texas. In SIC 36 (which includes semiconductors) the cost ratio is higher in Texas and in SIC 37 the cost ratio is higher in California.

Air pollution costs as a share of sales are higher in Texas in seven two digit manufacturing sectors. Costs in California are higher in eight sectors.

The largest difference is in Petroleum Products where total abatement costs represented 3.50% of sales in California in 1991 and 1.33% of sales in Texas.

4.1.6 Key Role of Petroleum Products Industry

The size of the Petroleum Products industry and the ratio of air pollution abatement costs to sales is the major determinant of how states ranked in the overall ranking of states on air pollution abatement costs. As shown on Table 4.8 six of the states listed in the comparison of states on Table 4.3 had a Petroleum Products industry. In three states - California, Texas and Washington - SIC 29 accounted for as much as 5% of manufacturing shipments led by Texas at 21.6%. However, California had the highest air pollution abatement costs/sales ratio among all states listed on Table 4.8.

Table 4.2

California and United States

AIR POLLUTION ABATEMENT COSTS AS A SHARE OF SALES AND TOTAL CAPITAL EXPENDITURES 1988-1991

(Percent)

		Operating Costs as a Share of Sales	Operating and Capital Costs As a Share of Sales	Capital Costs As a Share Of Capital Expenditures
U.S.	1991	0.18%	0.31%	3.75%
	1990	0.17%	0.26%	2.51%
	1989	0.17%	0.23%	1.87%
	1988	0.17%	0.22%	1.89%
Average	1988-91	0.17%	0.26%	2.54%
California	1991	0.21%	0.37%	5.03%
	1990	0.23%	0.33%	2.97%
	1989	0.16%	0.21%	1.50%
	1988	0.17%	0.26%	2.94%
Average	1988-91	0.20%	0.29%	3.09%

Source: Table 4.1 and Annual Survey of Manufactures(1991), U.S. Department of Commerce

4.1.7 Summary: US Department of Commerce Data

1. Operating and capital costs for air pollution were less than 0.5% of manufacturing sales in 1991 in all states reviewed in this study.

2. Texas had the highest cost ratio at 0.47% of sales.

3. California's ratio was 0.29% - slightly higher than the 0.26% national average.

4. In nine industries California's air pollution cost/sales ratios are below the national average while the state's ratio is higher in four industries.

5. The high cost/sales ratios in California and Texas are accounted for by the large expenditures in the Petroleum Products industry. Nearly two-thirds of California's air pollution abatement expenditures in 1991 were in the Petroleum Products industry.

6. California has the highest ratio of air pollution abatement costs as a share of sales in the petroleum industry among all states.

7. The Petroleum Products industry accounted for less than 1% of California's manufacturing jobs in 1991. Moreover, the petroleum markets in California are served primarily by California refiners. Petroleum is a local serving industry where additional costs will usually be translated into higher prices **not** relocation of economic activity.

Economic events in the Petroleum Products Industry in California did not make a significant contribution to the state's economic downturn after 1990.

Table 4.3

Selected States

AIR POLLUTION ABATEMENT COSTS

Average Annual Costs for 1988-1991

($Millions)

	Capital Costs	Operating Costs	Total Costs	Operating Costs as a Share of Sales	Operating and Capital Costs As a Share of Sales	Capital Costs As a Share of Capital Expenditures
U.S.	$2,402.9	$4,781.8	$7,184.7	0.17%	0.26%	2.54%
California	278.6	553.8	832.5	0.20%	0.29%	3.09%
Arizona	14.1	72.3	86.3	0.32%	0.38%	1.52%
Florida	42.5	102.5	144.9	0.17%	0.24%	2.27%
Georgia	99.3	114.0	213.2	0.14%	0.26%	3.44%
Massachusetts	14.5	39.6	54.0	0.06%	0.08%	0.74%
Michigan	106.6	197.3	303.9	0.13%	0.20%	2.04%
New York	88.3	103.7	192.0	0.07%	0.13%	1.82%
North Carolina	61.6	112.7	174.2	0.10%	0.15%	1.87%
Ohio	106.0	272.5	378.5	0.16%	0.22%	1.91%
Oregon	17.8	49.5	67.2	0.16%	0.22%	1.58%
Tennessee	65.2	90.3	155.5	0.14%	0.23%	2.27%
Texas	267.2	661.9	929.0	0.33%	0.47%	3.35%
Utah	15.8	30.7	46.5	0.23%	0.35%	3.40%
Washington	42.1	107.4	149.4	0.17%	0.24%	1.97%

Source: Pollution Abatement Costs and Expenditures - 1991, U.S. Department of Commerce and Annual Survey of Manufactures (1991), U.S. Department of Commerce

Table 4.4 (contd)
California
AIR POLLUTION ABATEMENT COSTS BY INDUSTRY
1991($Millions)

					Industry as Percent of Total		
Sic		Capital	Operating	Total	Capital	Operating	Total
20	Food Products	$9.6	$12.5	$22.1	2.2%	2.0%	2.1%
21	Tobacco						
22	Textiles						
24	Lumber, Wood Products	1.9	13.0	14.9	0.4%	2.1%	1.4%
25	Furniture		1.1	1.1	0.0%	0.2%	0.1%
26	Paper	10.1	12.1	22.2	2.3%	2.0%	2.1%
27	Printing & Publishing	3.0	28.7	31.7	0.7%	4.7%	3.0%
28	Chemicals	15.2	25.9	41.1	3.4%	4.2%	3.9%
29	Petroleum Products	292.4	399.9	692.3	65.9%	64.9%	65.3%
30	Rubber & Plastic Products	2.3	9.3	11.6	0.5%	1.5%	1.1%
32	Stone, Clay & Glass	34.3	28.6	62.9	7.7%	4.6%	5.9%
33	Primary Metal Products	3.4	13.2	16.6	0.8%	2.1%	1.6%
34	Fabricated Metal Products	6.0	14.4	20.4	1.4%	2.3%	1.9%
35	Industrial Machinery	2.9	3.0	5.9	0.7%	0.5%	0.6%
36	Electrical Machinery	17.7	12.2	29.9	4.0%	2.0%	2.8%
37	Transportation Equipment	42.3	38.0	80.3	9.5%	6.2%	7.6%
38	Instruments	2.1	4.2	6.3	0.5%	0.7%	0.6%
39	Misc Manufacturing		0.4	0.4	0.0%	0.1%	0.0%
	Total Manufacturing	$443.7	$616.4	$1,060.1	100.0%	100.0%	100.0%

Source Pollution Abatement Costs and Expenditures-1991, U.S. Department of Commerce

Table 4.4
United States
AIR POLLUTION ABATEMENT COSTS BY INDUSTRY
1991($Millions)

					Industry as Percent of Total		
Sic		Capital	Operating	Total	Capital	Operating	Total
20	Food Products	$95.6	$149.6	$245.2	2.6%	3.0%	2.8%
21	Tobacco	3.8	16.4	20.2	0.1%	0.3%	0.2%
22	Textiles	27.8	36.1	63.9	0.8%	0.7%	0.7%
24	Lumber, Wood Products	102.0	91.1	193.1	2.8%	1.8%	2.2%
25	Furniture	16.2	45.9	62.1	0.4%	0.9%	0.7%
26	Paper	480.8	400.8	881.6	13.0%	8.1%	10.2%
27	Printing & Publishing	26.8	87.7	114.5	0.7%	1.8%	1.3%
28	Chemicals	816.4	879.6	1,696.0	22.0%	17.7%	19.6%
29	Petroleum Products	996.7	1,464.7	2,461.4	26.9%	29.6%	28.4%
30	Rubber & Plastic Products	50.8	121.0	171.8	1.4%	2.4%	2.0%
32	Stone, Clay & Glass	119.9	220.5	340.4	3.2%	4.4%	3.9%
33	Primary Metal Products	499.2	911.7	1,410.9	13.5%	18.4%	16.3%
34	Fabricated Metal Products	80.7	133.8	214.5	2.2%	2.7%	2.5%
35	Industrial Machinery	88.7	70.0	158.7	2.4%	1.4%	1.8%
36	Electrical Machinery	90.7	100.0	190.7	2.4%	2.0%	2.2%
37	Transportation Equipment	175.8	254.7	430.5	4.7%	5.1%	5.0%
38	Instruments	27.1	33.3	60.4	0.7%	0.7%	0.7%
39	Misc Manufacturing	7.3	14.5	21.8	0.2%	0.3%	0.3%
	Total Manufacturing	$3,706.3	$4,955.6	$8,661.9	100.0%	100.0%	100.0%

Table 4.6
California and United States
INDUSTRY JOBS AND SHIPMENTS AS SHARE OF TOTAL MANUFACTURING
1991(Percent)

		United States		California	
Sic					
20	Food Products	9.3%	14.0%	10.0%	14.4%
21	Tobacco	0.9%	1.2%	N/A	N/A
22	Textiles	3.8%	2.4%	6.8%	3.3%
24	Lumber, Wood Products	4.0%	2.6%	3.4%	2.2%
25	Furniture	2.9%	1.4%	2.9%	1.5%
26	Paper	3.9%	4.7%	2.1%	2.6%
27	Printing & Publishing	9.4%	5.7%	9.8%	6.0%
28	Chemicals	5.3%	10.6%	3.2%	4.9%
29	Petroleum Products	0.7%	5.7%	0.9%	6.8%
30	Rubber & Plastic Products	5.3%	3.6%	4.6%	2.9%
31	Leather	0.7%	0.3%	N/A	N/A
32	Stone, Clay & Glass	3.0%	2.2%	2.8%	2.2%
33	Primary Metal Products	4.3%	4.8%	1.9%	2.0%
34	Fabricated Metal Products	8.6%	5.7%	7.7%	5.1%
35	Industrial Machinery	11.2%	8.8%	11.0%	10.5%
36	Electrical Machinery	9.0%	7.2%	13.3%	10.6%
37	Transportation Equipment	10.3%	13.2%	15.6%	14.6%
38	Instruments	5.7%	4.6%	10.8%	8.2%
39	Misc Manufacturing	2.3%	1.3%	2.2%	1.4%
	TOTAL	100.0%	100.0%	100.0%	100.0%

Source Annual Survey of Manufactures – 1991, U.S. Department of Commerce

Table 4.5
California and United States
AIR POLLUTION ABATEMENT COSTS AS A SHARE OF SALES AND CAPITAL EXPENDITURES BY INDUSTRY
1991
(Percent)

		United States			California		
Sic		Capital Costs As a Share Of	Operating Costs As a	Total Costs As a Share	Capital Costs As a Share Of	Operating Costs As a Share Of	Total Costs As a Share Of
20	Food Products	0.02%	0.04%	0.06%	0.02%	0.03%	0.05%
21	Tobacco	0.01%	0.05%	0.06%			
22	Textiles	0.04%	0.05%	0.10%			
24	Lumber, Wood Products	0.14%	0.13%	0.27%	0.03%	0.20%	0.23%
25	Furniture	0.04%	0.11%	0.16%			
26	Paper	0.37%	0.31%	0.68%	0.14%	0.16%	0.30%
27	Printing & Publishing	0.02%	0.06%	0.07%	0.02%	0.17%	0.18%
28	Chemicals	0.28%	0.30%	0.58%	0.11%	0.18%	0.29%
29	Petroleum Products	0.63%	0.93%	1.56%	1.48%	2.02%	3.50%
30	Rubber & Plastic Products	0.05%	0.12%	0.17%	0.03%	0.11%	0.14%
32	Stone, Clay & Glass	0.20%	0.37%	0.57%	0.54%	0.45%	1.00%
33	Primary Metal Products	0.38%	0.69%	1.06%	0.06%	0.23%	0.29%
34	Fabricated Metal Products	0.05%	0.09%	0.14%	0.04%	0.10%	0.14%
35	Industrial Machinery	0.04%	0.03%	0.07%	0.01%	0.01%	0.02%
36	Electrical Machinery	0.05%	0.05%	0.10%	0.06%	0.04%	0.10%
37	Transportation Equipment	0.05%	0.07%	0.12%	0.10%	0.09%	0.19%
38	Instruments	0.02%	0.03%	0.05%	0.01%	0.02%	0.03%
39	Misc Manufacturing	0.02%	0.04%	0.06%	0.00%	0.01%	0.01%

Source Pollution Abatement Costs and Expenditures – 1991, U.S. Department of Commerce and Annual Survey of Manufactures(1991), U.S. Department of

Table 4.8

COMPARISON OF PETROLEUM INDUSTRY STATISTICS

1991

	Sales ($millions)			
	Petroleum Products	**Total Manufacturing**	**Petroleum Sales As % of Total Manufacturing**	**Air Pollution Abatement Costs as a Share of Sales**
United States	$158,076.4	$2,826,207.3	5.6%	1.6%
California	19,796.6	289,612.5	6.8%	3.5%
Florida	290.4	59,275.0	0.5%	
Michigan	1,532.8	143,102.6	1.1%	
Ohio	5,467.7	174,927.6	3.1%	
Texas	44,166.2	204,001.5	21.6%	1.3%
Washington	3,830.2	67,978.3	5.6%	2.0%

Source: Pollution Abatement Costs and Expenditures - 1991, U.S. Department of Commerce and Annual Survey of Manufactures (1991), U.S. Department of Commerce

Table 4.7
California and Texas
AIR POLLUTION ABATEMENT COSTS AS A SHARE OF SALES AND CAPITAL EXPENDITURES BY INDUSTRY
1991
(Percent)

		Texas			California		
		Capital Costs	Operating	Total Costs	Capital Costs	Operating Costs	Total Costs
20	Food Products	0.02%	0.04%	0.06%	0.02%	0.03%	0.05%
21	Tobacco						
22	Textiles						
24	Lumber, Wood Products	0.09%	0.35%	0.45%	0.03%	0.20%	0.23%
25	Furniture						
26	Paper	0.00%	0.00%	0.00%	0.14%	0.16%	0.30%
27	Printing & Publishing	0.00%	0.03%	0.03%	0.02%	0.17%	0.18%
28	Chemicals	0.41%	0.50%	0.91%	0.11%	0.18%	0.29%
29	Petroleum Products	0.47%	0.85%	1.33%	1.48%	2.02%	3.50%
30	Rubber & Plastic Products	0.22%	0.04%	0.25%	0.03%	0.11%	0.14%
32	Stone, Clay & Glass	0.10%	0.51%	0.61%	0.54%	0.45%	1.00%
33	Primary Metal Products	0.65%	0.75%	1.40%	0.06%	0.23%	0.29%
34	Fabricated Metal Products	0.02%	0.02%	0.04%	0.04%	0.10%	0.14%
35	Industrial Machinery	0.00%	0.01%	0.01%	0.01%	0.01%	0.02%
36	Electrical Machinery	0.05%	0.13%	0.17%	0.06%	0.04%	0.10%
37	Transportation Equipment	0.01%	0.04%	0.05%	0.10%	0.09%	0.19%
38	Instruments	0.00%	0.00%	0.00%	0.01%	0.02%	0.03%
39	Misc Manufacturing	0.02%	0.04%	0.06%	0.00%	0.01%	0.01%

Source: Pollution Abatement Costs and Expenditures - 1991, U.S. Department of Commerce and Annual Survey of Manufactures(1991), U.S. Department

Table 4.9

SCAQMD ex ante Costs

SIC CODE	Industry	Percentage of Total Cost	Cumulative Cost	% of Non agricultural Jobs in CA June 1990
49	Electric, Gas and Sanitation Services	30.0%	30.0%	0.7%
29	Petroleum & Coal Products	22.4%	52.5%	0.2%
36	Electronic & Other Electric Equipment	9.7%	62.1%	2.0%
10 - 14	Oil & Gas Extraction, Mining	8.9%	71.1%	0.3%
37	Transportation Equipment	5.2%	76.2%	2.3%
75	Auto Repair Service	3.8%	80.1%	1.5%
	All SCAQMD Regulated Industries	100.0%	100.0%	100.0%*

* This is the total of all California non-agricultural industries

The data are also consistent with the Department of Commerce data discussed in the previous section. Utilities, Petroleum and electrical equipment industries bear the greatest burden of air quality regulations in the South Coast district.

One of the reasons why air quality regulations might be expected to account for only a small part of business location decisions is that air pollution control costs are highly concentrated in a few industries. As reported in Table 4.9 six industries accounted for 80% of air pollution control costs in estimates prepared by SCAQMD.

4.2 South Coast Air Quality Management District ex-ante Cost Data

SCAQMD and other air quality districts are required to estimate the economic cost likely to be imposed by proposed regulations. All districts were requested to provide these data for this project. ARB staff also provided contacts and requested the districts to help the research team by providing the needed information.

However, no district, other than the South Coast Air Quality District, provided sufficient data to put together in meaningful tables. A thorough and methodical research was conducted of the SCAQMD archives with the help of the district staff. A large number of documents were researched to compile a complete listing of staff studies of cost anticipated from the proposed rules and regulations. Sometimes these studies were quite detailed while at other times only a brief description of the procedures used was available. Because of changing, often improving, methodological procedures used, it is not clear whether the district estimates are strictly comparable over time. Appendix A gives complete documentation of the employment and dollar estimates of anticipated impacts undertaken by the district staff. The costs are provided by regulation and by SIC.

SCAQMD and other districts regulate stationary sources of air pollution. Thus their cost data only reflect their cost estimates for the stationary sources. These estimates were made based on vendor data, models of production activity in various industries and the state of available technology at the time regulations were being considered. Therefore, the estimates may vary greatly from actual costs (i.e., higher or lower). The district cost data allocation by SIC is also not strictly comparable to that done by the Department of Commerce.

It is, however, possible to identify industry categories most affected by SCAQMD regulations as shown in Table 4.9. The costs of these regulations are concentrated in a small number of industries. Electric, gas, and sanitation services account for the largest category of 30% while Petroleum and coal products is next with 22.4%. Six industry categories account for over 80% of SCAQMD's total cost estimates.

Table 4.10

Air Pollution Control Equipment Market by End-User

End-User Industry	Share
Electric Utilities	42%
Chemical, Pharm. & Plastics	8%
Pulp & Paper	8%
Independent Power Producers	7%
Incinerators & Waste-to-Energy	6%
Petroleum Refining	6%
Auto/Machinery Manufacturing	4%
Primary Metals	3%
Other	16%

Source: Environmental Business Journal, March 1995, p.3

Air quality regulators have stated that in most cases the actual equipment costs are significantly lower than those stated by industry at the time regulations were being adopted. It is not possible to verify these claims without a much deeper analysis which is outside the scope of this study.

We turn now to the survey of the California businesses conducted by the Institute for Economic and Environmental Studies to estimate direct and indirect costs of air quality regulations.

These six industries accounted for just 7% of state jobs in June 1990 at the beginning of the recession. The two industries - utilities and petroleum - which accounted for 50% of air pollution costs represented just 1% of non-agricultural wage and salary jobs in California.

4.3 Other Cost Estimates

An alternative measure of the control equipment costs may be derived from the sale of such equipment to end-users. This will not, of course, be a comprehensive measure in the sense of the Department of Commerce data, but can still provide useful, though limited, information. Only national statistics are available in the published form. According to the latest issue of the Environmental Business Journal (March 1995) electric utilities purchase 42% of the air pollution control equipment (Table 4.10). If one were to include independent power producers in this category, the share goes up to 49%. Other major industries were chemical, pharmaceutical and plastics, and pulp and paper. These are the same industries which have earlier been identified in the Department of Commerce data as bearing the major cost of air pollution costs.

Chapter 5

PROJECT SURVEY: METHODOLOGY, DESIGN, AND DATA

As the review of literature in Chapter 3 on location decisions by firms shows, a number of rather difficult issues are not addressed by currently available surveys. None of the studies makes any attempt to directly estimate the cost of compliance or nonqualitative impacts of air quality regulations in California or to analyze impacts on the state economy. This project conducted a survey of California firms subject to air quality regulations in an attempt to address these issues. This chapter describes the survey instrument developed for this task, methodological issues involved, and the data collection procedures. The results of the survey are discussed in the next chapter.

There were 21,938 firms in the database provided to us by the ARB which represents 2.9% of all firms in California. All of these firms are subject to one or more air quality regulations. Upon examination, it was discovered that the database had a large number of errors. These ranged from wrong and missing addresses to non-existent firms. A great deal of effort was spent verifying addresses, getting telephone numbers and identifying appropriate individuals to whom the survey should be sent. The final sample contained 2,143 firms randomly selected which represented 9.8% of the ARB database (see further discussion below for the sampling methodology).

5.1 Methodological Considerations

5.1.1 Statistical Validity

Care was taken in designing and conducting the survey so that results would have statistical validity not only for the overall sample but also for subsamples, e.g., by geographic size

Table 5.1
DISTRIBUTION OF FIRMS BY SIC

		CALIFORNIA		ARB DATABASE			SAMPLE			RESPONSE		
		# of	# of	# of	# of	# of CA	# of	# of	# of ARB	# of	# of	# of
SIC	SIC NAME	firms	Total	firms	Total	Population	firms	Total	Database	firms	Total	Sample
7	Agricultural Services	11,344	1.5%	226	1.0%	2.0%	29	1.4%	12.8%	4	1.6%	13.8%
13	Oil & Gas Extraction	798	0.1%	768	3.5%	96.0%	56	2.6%	7.3%	9	3.6%	16.1%
14	Nonmetalic Minrls,Excl.Fuels	325	0.0%	223	1.0%	68.6%	27	1.3%	12.1%	7	2.8%	25.9%
17	Special Trade Contractors	41,746	5.6%	190	0.9%	0.5%	15	0.7%	7.9%	3	1.2%	20.0%
20	Food & Kindred Products	2,644	0.4%	495	2.3%	18.7%	61	2.8%	12.3%	8	3.2%	13.1%
22	Textile Mill Products	446	0.1%	113	0.5%	25.3%	15	0.7%	13.3%	2	0.8%	13.3%
23	Apparel & Fabric Products	5,914	0.8%	47	0.2%	0.8%	10	0.5%	21.3%	1	0.4%	10.0%
24	Lumber & Wood Products	2,814	0.4%	438	2.0%	15.6%	40	1.9%	9.1%	6	2.4%	15.0%
25	Furniture & Fixtures	1,760	0.2%	372	1.7%	21.1%	32	1.5%	8.6%	5	2.0%	15.6%
26	Paper & Allied Products	619	0.1%	151	0.7%	24.4%	25	1.2%	16.6%	1	0.4%	4.0%
27	Printing & Publishing	8,267	1.1%	339	1.5%	4.1%	36	1.7%	10.6%	6	2.4%	16.7%
28	Chemicals & Allied Products	1,418	0.2%	552	2.5%	38.9%	52	2.4%	9.4%	8	3.2%	15.4%
29	Petroleum & Coal Products	226	0.0%	319	1.5%	141.2%	25	1.2%	7.8%	7	2.8%	28.0%
30	Rubber & Misc. Plastic Prod.	2,084	0.3%	349	1.6%	16.7%	34	1.6%	9.7%	8	3.2%	23.5%
32	Stone, Clay & Glass Prod.	1,650	0.2%	539	2.5%	32.7%	54	2.5%	10.0%	6	2.4%	11.1%
33	Primary Metal Industries	686	0.1%	350	1.6%	51.0%	34	1.6%	9.7%	1	0.4%	2.9%
34	Fabricated Metal Products	4,581	0.6%	1,477	6.7%	32.2%	132	6.2%	8.9%	12	4.8%	9.1%
35	Industrial Machinery & Equpmnt	7,041	0.9%	671	3.1%	9.5%	64	3.0%	9.5%	8	3.2%	12.5%
36	Electronic/Other Elect.Equpmnt	3,640	0.5%	771	3.5%	21.2%	82	3.8%	10.6%	11	4.4%	13.4%
37	Transportation Equipment	1,611	0.2%	550	2.5%	34.1%	51	2.4%	9.3%	7	2.8%	13.7%
38	Instruments & Related Prod.	2,003	0.3%	235	1.1%	11.7%	22	1.0%	9.4%	3	1.2%	13.6%
39	Misc. Manufacturing Industries	2,329	0.3%	179	0.8%	7.7%	20	0.9%	11.2%	2	0.8%	10.0%
42	Trucking & Warehousing	10,894	1.5%	42	0.2%	0.4%	7	0.3%	16.7%	2	0.8%	28.6%
45	Transportation by Air	1,276	0.2%	111	0.5%	8.7%	12	0.6%	10.8%	4	1.6%	33.3%
47	Transportation Services	6,587	0.9%	17	0.1%	0.3%	2	0.1%	11.8%	1	0.4%	50.0%
49	Electric, Gas, Sanitary Services	1,611	0.2%	755	3.4%	46.9%	74	3.5%	9.8%	5	2.0%	6.8%
50	Wholesale Trade-Durable Goods	35,777	4.8%	288	1.3%	0.8%	31	1.4%	10.8%	5	2.0%	16.1%
51	Whlsale Trade-Nondurable Good	20,177	2.7%	369	1.7%	1.8%	43	2.0%	11.7%	11	4.4%	25.6%
53	General Merchandise Stores	2,640	0.4%	69	0.3%	2.6%	7	0.3%	10.1%	1	0.4%	14.3%
54	Food Stores	19,100	2.6%	31	0.1%	0.2%	3	0.1%	9.7%	2	0.8%	66.7%
55	Auto Dealers,Gas Service Stas	18,357	2.5%	361	1.6%	2.0%	38	1.8%	10.5%	5	2.0%	13.2%
57	Furniture,Homefurnishing Str	13,682	1.8%	51	0.2%	0.4%	5	0.2%	9.8%	1	0.4%	20.0%
58	Eating&Drinking Places	49,571	6.6%	1,420	6.5%	2.9%	117	5.5%	8.2%	3	1.2%	2.6%
59	Misc. Retail	38,705	5.2%	46	0.2%	0.1%	5	0.2%	10.9%	1	0.4%	20.0%
62	Security&Commodity Brokers	3,115	0.4%	9	0.0%	0.3%	1	0.0%	11.1%	1	0.4%	100.0%

and Standard Industrial Classification (SIC). This meant ensuring randomness and minimum size both at the subsample and the overall sample levels. An examination of the sample distributions in comparison with distribution of all firms in the ARB database and the overall state economy shows that the sample selected is indeed a very good representation of its underlying population.

Two tables, 5.1 and 5.2, show distributions by (SIC) and by county for all California business firms, the ARB database, the sample selected, and the response group. The distribution of firms in the sample and those firms which responded to the survey is also quite consistent.

5.1.2 Industry Coverage

The number of firms and shares of industries in the ARB regulated sector is different from that of the overall state economy. It is important, therefore, that the selected sample be a microcosm of the firms subject to air quality regulations in the state. In particular, the number of firms by SIC in the sample must represent the distribution of the regulated firms in various SIC sectors. This was ensured by adopting appropriate sampling procedures as described below.

Table 5.1 shows the results of the selection procedure. It shows the distribution of firms by Standard Industrial Classification (SIC) in the state, the industries population affected by air quality regulations, survey sample and the completed surveys. The distribution indicates close resemblance between the selected sample and the overall firm distribution. Each SIC is fairly represented in the selected sample and the response group in proportion to its overall share in the economy and the sector regulated by ARB.

5.1.3. Geographic coverage

Care was also taken to ensure good geographical representation of firms. The sample firms represent geographic locations in proportion to their share of the state totals and the ARB database. Table 5.2 shows the distribution of firms by county for the state of California, ARB database, sample and responding firms. It is clear that the selected sample closely matches the geographic firm distribution at the state level as well as that represented by the ARB database of the regulated sector (for air quality) of the state's economy.

Table 5.1
DISTRIBUTION OF FIRMS BY SIC

		CALIFORNIA		ARB DATABASE			SAMPLE			RESPONSE		
		# of	# of	# of	# of	# of CA	# of	# of	# of ARB	# of	# of	# of
SIC	SIC NAME	firms	Total	firms	Total	Population	firms	Total	Database	firms	Total	Sample
65	Real Estate	32,497	4.3%	219	1.0%	0.7%	18	0.8%	8.2%	3	1.2%	16.7%
70	Hotels&Other Lodging Places	6,224	0.8%	117	0.5%	1.9%	14	0.7%	12.0%	1	0.4%	7.1%
72	Personal Services	20,189	2.7%	2,917	13.3%	14.4%	299	14.0%	10.3%	27	10.8%	9.0%
73	Business Services	43,123	5.8%	229	1.0%	0.5%	24	1.1%	10.5%	1	0.4%	4.2%
75	Auto Repair/Services/Parking	21,482	2.9%	2,523	11.5%	11.7%	240	11.2%	9.5%	33	13.1%	13.8%
80	Health Services	61,796	8.3%	316	1.4%	0.5%	36	1.7%	11.4%	6	2.4%	16.7%
82	Educational Services	5,179	0.7%	329	1.5%	6.4%	34	1.6%	10.3%	1	0.4%	2.9%
83	Social Services	15,034	2.0%	14	0.1%	0.1%	4	0.2%	28.6%	1	0.4%	25.0%
87	Engineering/Mngmnt Services	32,217	4.3%	182	0.8%	0.6%	19	0.9%	10.4%	3	1.2%	15.8%
89	Other Services	2,777	0.4%	6	0.0%	0.2%	1	0.0%	16.7%	1	0.4%	100.0%
	Other	181,732	24.3%	2,165	9.9%	1.2%	193	9.0%	8.9%	7	2.8%	3.6%
	TOTAL	747,688	100.0%	21,938	100.0%	2.9%	2,143	100.0%	9.8%	251	100.0%	11.7%

NOTE: The State data are from 1991 County Business Patterns (CBP).
Either the CBP or the ARB data for SIC29 is in error but it is not clear which one.

Table 5.2 (contd)
DISTRIBUTION OF FIRMS BY COUNTY

	CALIFORNIA		ARB DATABASE			SAMPLE			RESPONSE		
COUNTY	# of	# of	# of	# of	# of CA	# of	# of	# of ARB	# of	# of	# of
	firms	Total	firms	Total	opulati	firms	Total	Database	firms	Total	Sample
SAN LOUIS OBISPO	6,039	0.8%	46	0.2%	0.8%	6	0.3%	13.0%	1	0.4%	16.7%
SAN MATEO	18,704	2.5%	410	1.9%	2.2%	51	2.4%	12.4%	5	2.0%	9.8%
SANTA BARBARA	10,384	1.4%	214	1.0%	2.1%	25	1.2%	11.7%	1	0.4%	4.0%
SANTA CLARA	39,573	5.3%	1,025	4.7%	2.6%	133	6.2%	13.0%	20	8.0%	15.0%
SANTA CRUZ	6,718	0.9%	18	0.1%	0.3%	0	0.0%	0.0%	0	0.0%	0.0%
SHASTA	4,571	0.6%	19	0.1%	0.4%	4	0.2%	21.1%	1	0.4%	25.0%
SIERRA	78	0.0%	3	0.0%	3.8%	0	0.0%	0.0%	0	0.0%	0.0%
SISKIYOU	1,301	0.2%	2	0.0%	0.2%	1	0.0%	50.0%	0	0.0%	0.0%
SOLANO	6,084	0.8%	149	0.7%	2.4%	19	0.9%	12.8%	2	0.8%	10.5%
SONOMA	12,130	1.6%	230	1.0%	1.9%	28	1.3%	12.2%	5	2.0%	17.9%
STANISLAUS	7,794	1.0%	47	0.2%	0.6%	6	0.3%	12.8%	0	0.0%	0.0%
SUTTER	1,576	0.2%	18	0.1%	1.1%	3	0.1%	16.7%	0	0.0%	0.0%
TEHAMA	977	0.1%	16	0.1%	1.6%	1	0.0%	6.3%	1	0.4%	100.0%
TRINITY	317	0.0%	1	0.0%	0.3%	0	0.0%	0.0%	0	0.0%	0.0%
TULARE	5,873	0.8%	35	0.2%	0.6%	1	0.0%	2.9%	1	0.4%	100.0%
TUOLUMNE	1,531	0.2%	12	0.1%	0.8%	4	0.2%	33.3%	1	0.4%	25.0%
VENTURA	15,170	2.0%	432	2.0%	2.8%	40	1.9%	9.3%	4	1.6%	10.0%
YOLO	3,183	0.4%	25	0.1%	0.8%	4	0.2%	16.0%	1	0.4%	25.0%
YUBA	936	0.1%	11	0.1%	1.2%	0	0.0%	0.0%	0	0.0%	0.0%
UNKNOWN	79	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%
TOTAL	**747,688**	**100.0%**	**21,938**	**100.0%**	**2.9%**	**2,143**	**100.0%**	**9.8%**	**251**	**100.0%**	**11.7%**

Table 5.2
DISTRIBUTION OF FIRMS BY COUNTY

	CALIFORNIA		ARB DATABASE			SAMPLE			RESPONSE		
COUNTY	# of	# of	# of	# of	# of CA	# of	# of	# of ARB	# of	# of	# of
	firms	Total	firms	Total	opulati	firms	Total	Database	firms	Total	Sample
ALAMEDA	33,057	4.4%	830	3.8%	2.5%	120	5.6%	14.5%	15	6.0%	12.5%
ALPINE	42	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%
AMADOR	839	0.1%	19	0.1%	2.3%	2	0.1%	10.5%	0	0.0%	0.0%
BUTTE	4,669	0.6%	37	0.2%	0.8%	6	0.3%	16.2%	0	0.0%	0.0%
CALAVERAS	860	0.1%	4	0.0%	0.5%	0	0.0%	0.0%	0	0.0%	0.0%
COLUSA	360	0.0%	41	0.2%	11.4%	6	0.3%	14.6%	1	0.4%	16.7%
CONTRA COSTA	20,514	2.7%	407	1.9%	2.0%	41	1.9%	10.1%	5	2.0%	12.2%
DEL NORTE	601	0.1%	4	0.0%	0.7%	1	0.0%	25.0%	0	0.0%	0.0%
EL DORADO	3,446	0.5%	13	0.1%	0.4%	2	0.1%	15.4%	1	0.4%	50.0%
FRESNO	15,057	2.0%	157	0.7%	1.0%	26	1.2%	16.6%	3	1.2%	11.5%
GLENN	508	0.1%	51	0.2%	10.0%	6	0.3%	11.8%	1	0.4%	16.7%
HUMBOLDT	3,555	0.5%	17	0.1%	0.5%	3	0.1%	17.6%	1	0.4%	33.3%
IMPERIAL	2,198	0.3%	29	0.1%	1.3%	4	0.2%	13.8%	0	0.0%	0.0%
INYO	617	0.1%	21	0.1%	3.4%	5	0.2%	23.8%	1	0.4%	20.0%
KERN	10,954	1.5%	175	0.8%	1.6%	25	1.2%	14.3%	5	2.0%	20.0%
KINGS	1,426	0.2%	45	0.2%	3.2%	3	0.1%	6.7%	0	0.0%	0.0%
LAKE	1,153	0.2%	22	0.1%	1.9%	3	0.1%	13.6%	2	0.8%	66.7%
LASSEN	566	0.1%	6	0.0%	1.1%	1	0.0%	16.7%	0	0.0%	0.0%
LOS ANGELES	218,714	29.3%	11,024	50.3%	5.0%	848	39.6%	7.7%	91	36.3%	10.7%
MADERA	1,723	0.2%	18	0.1%	1.0%	3	0.1%	16.7%	0	0.0%	0.0%
MARIN	9,472	1.3%	121	0.6%	1.3%	20	0.9%	16.5%	2	0.8%	10.0%
MARIPOSA	371	0.0%	3	0.0%	0.8%	0	0.0%	0.0%	0	0.0%	0.0%
MENDOCINO	2,622	0.4%	8	0.0%	0.3%	1	0.0%	12.5%	0	0.0%	0.0%
MERCED	2,802	0.4%	117	0.5%	4.2%	18	0.8%	15.4%	4	1.6%	22.2%
MODOC	203	0.0%	3	0.0%	1.5%	0	0.0%	0.0%	0	0.0%	0.0%
MONO	492	0.1%	5	0.0%	1.0%	1	0.0%	20.0%	0	0.0%	0.0%
MONTREY	8,117	1.1%	27	0.1%	0.3%	4	0.2%	14.8%	1	0.4%	25.0%
NAPA	3,223	0.4%	71	0.3%	2.2%	14	0.7%	19.7%	3	1.2%	21.4%
NEVADA	2,602	0.3%	20	0.1%	0.8%	1	0.0%	5.0%	1	0.4%	100.0%
ORANGE	71,462	9.6%	3,137	14.3%	4.4%	328	15.3%	10.5%	43	17.1%	13.1%
PLACER	5,744	0.8%	43	0.2%	0.7%	8	0.4%	18.6%	0	0.0%	0.0%
PLUMAS	626	0.1%	18	0.1%	2.9%	1	0.0%	5.6%	0	0.0%	0.0%
RIVERSIDE	22,826	3.1%	860	3.9%	3.8%	90	4.2%	10.5%	11	4.4%	12.2%
SACRAMENTO	25,193	3.4%	72	0.3%	0.3%	12	0.6%	16.7%	1	0.4%	8.3%
SAN BENITO	735	0.1%	7	0.0%	1.0%	0	0.0%	0.0%	0	0.0%	0.0%
SAN BERNERDINO	25,326	3.4%	1,172	5.3%	4.6%	134	6.3%	11.4%	11	4.4%	8.2%
SAN DIEGO	60,541	8.1%	213	1.0%	0.4%	31	1.4%	14.6%	3	1.2%	9.7%
SAN FRANCISCO	31,628	4.2%	321	1.5%	1.0%	37	1.7%	11.5%	2	0.8%	5.4%
SAN JOAQUIN	9,826	1.3%	87	0.4%	0.9%	12	0.6%	13.8%	0	0.0%	0.0%

groupings reduces the cost of conducting the survey because less survey responses are needed to obtain accurate population estimates.

The first step in the selection of a stratified sample is to specify the strata; then each sampling unit in the population is placed into its appropriate stratum. After the sampling units are divided into strata, a simple random sample from each strata is selected. In many cases, however, if the strata occur naturally no actual population classification is needed. This was the case in this study. The population elements were all firms currently operating in California and the naturally-occurring non-overlapping groups (strata) were the type of industry (as defined by the 4-digit SIC codes).

In order to select the stratified random sample to be used in this study, a list of firms subject to air quality regulations was provided by ARB staff. The database file had relevant fields such as identification number, names of firms, 4-digit SIC code, address, telephone number, contact person, and number of employees. According to this list, the total number of firms subject to air quality regulations during the 1993 calendar year was 21,938.

To obtain a representative random sample of all firms currently operating in California, a survey group of 10% was selected. This sample size was selected to ensure a 5% error interval on the population estimate. By this method, the necessary survey group to conduct this study was determined to be approximately 2,200 firms. A number of four digit SIC had less than 10 firms in them. To ensure that we did not completely miss out on these industries, the ARB database was divided into two groups based on the number of firms. The cutoff point for this group classification was set at 10 firms. As such, each type of industry that had less than 10 firms was defined as one group, and those above 10 formed the second group. This classification was necessary in order to obtain a representative sample of firms from all types of industries. At least one firm was randomly selected for each of the small size four digit SIC category.

In order to determine the level of participation of each large industry, the number of firms in that industry was divided by the total number of firms (N = 21,938). The resulting number indicated the percentage which that industry represented of the total firm population. The industry

5.2 Survey Design

The survey design refers to the construction of the survey instrument, sampling methodology, and data collection procedures.

5.2.1 Survey Instrument

The survey instrument was composed of 24 questions and a copy is attached as Appendix B. It can be divided into five different segments: (1) basic firm information, (2) ranking of business climate factors, regulations in general and air quality regulations in particular, (3) costs of compliance data, (4) flexibility and new product development, and (5) business location questions. The questions were designed and asked in a manner to elicit the most objective and unbiased responses possible keeping in mind limitations of survey methodology in general. For example, the location questions were posed last. The cost of compliance questions requested for both absolute and percentage expenditure by four different categories. The questions on the size of the firm asked for both employment and sales data.

Every attempt was made to keep the survey instrument size small. A number of available survey instruments were reviewed. A pre-test was conducted for a sample of fifty firms and some of the questions were revised and reordered in light of problems encountered.

5.2.2 Sampling Procedure

The sample used in this survey was selected using a stratified random sampling procedure. A stratified random sample is obtained by separating the population elements into non-overlapping groups, called strata, and then selecting a random sample from each stratum. The principle reasons for using the stratified random sampling procedure to conduct this study were: (i) stratification usually produces a much smaller bound on the error of estimation than other sampling procedures, and (ii) the natural stratification of the population elements into convenient

2,143 firms throughout Southern, Central, and Northern California in two mailings three weeks apart.

Four weeks were allowed for survey returns. In order to maximize participation in the survey study, a second letter was sent out to the non-respondents reminding them of the importance of the survey and encouraging them to return the survey forms (see Appendix D). Follow-up phone calls were made to firms who had not returned the surveys after four weeks. A total of 251 firms in the sample finally returned surveys. This represents 11.8% of the 2,143 sampled firms. In spite of a very time-consuming and intensive effort at survey completion, the response rate is below what was expected though comparable to similar industry surveys.

A number of reasons lie behind it. The intrusive nature of the questions asked, for example, the need to know the actual cost data for various categories and data on sales, made the firms reluctant. Often they did not know what it cost them to comply with the regulations and getting that information was very time-consuming or simply impossible for them. But the most common responses was a point-blank refusal to give any information and expressions of anger at the regulators. In spite of lower than expected response rate, the distribution of the firms that completed the survey is proportionate to the original sample and the ARB database. Although the error interval in the population estimates is considerably larger than the proposed 5%, the completed surveys represent a significant sample from which a number of valid inferences can be drawn.

One must also be aware of a potential problem of response bias. Response bias occurs because some firms are more likely to respond to the survey than others. As a result, the final sample from which information is drawn can be non-representative of the general population of regulated firms. Usually, survey researchers expect respondents in a survey such as ours to be those firms that are most affected by regulations, most angry, or in other ways feel strongly about the regulations. Conversely, firms that do not care much about air pollution regulations are expected to respond less frequently.

percentage was then multiplied by the required number of survey firms. This result indicated how many firms should be surveyed in each industry. For example, SIC 57 (Furniture and Home Furnishing) Industry (n = 51 firms) required that five firms be selected in the sample (i.e., 51/ 21,938 = 0.2%, and 0.2% of 2,200 = 5 firms selected). For industries that qualified more than one firm for the survey sample, the actual firms were chosen by simple random sampling. For example, the five firms in the SIC 57 Industry were chosen by numbering the 51 firms in the industry and randomly selecting the required sample size. Based on this method, both small and large industries qualified at least one firm for the sample. As described above, after cleaning up the database for errors of addresses, contact person, location and other identifying information, an actual sample of 2,143 firms was selected from the ARB database.

5.2.3 Data Collection

The project proposal had designated Social Science Research Center (SSRC) California State University, Fullerton as the entity to conduct the actual survey. However, by the time the survey was ready to go out in May of 1994, the SSRC was undergoing major restructuring that had the potential of jeopardizing this project. It also became clear that a substantial effort would have to be devoted to cleaning up the database for address corrections, telephone numbers, and respondent identification. This was not anticipated or planned for when the proposal was made. SSRC's cost estimate for data clean-up and survey work were considerably higher than the proposal budget. It was decided, therefore, to use their services only in limited consultative capacity. The actual survey was closely supervised by the research team in collaboration with SSRC.

The months of May through August 1994, were spent conducting the survey. A letter of introduction was obtained from Mr. Kirk West, President of the California Chamber of Commerce, to improve the response rate and assure confidentiality of the survey. The letter requested the firm's cooperation for conducting the survey (see Appendix C). In addition to the letter, each manager received a survey questionnaire and a stamped return envelope addressed to California State University, Fullerton. Questionnaires were distributed to all of the

Chapter 6

PROJECT SURVEY - RESULTS

While reviewing the following survey results it must be emphasized that this is a survey of firms which are subject to air quality regulations. In a sense, this is a captive audience which is familiar with the regulatory environment for air quality and perhaps has formed opinions about the process. The survey results are summarized below by various categories.

6.1 The Importance Of Firm Size and Significance Of Regulations

Government regulations in general, and air quality regulations in particular, affect different size firms differently. In a number of questions there is a remarkable difference in response of firms based on their size, as measured by employment and sales. For example, 95% of the firms with employment size of ten employees or under regarded government regulations as very important to their business (Table 6.1). Eighty three percent of these firms ranked air quality regulations as the most important from among four types of regulations including health and safety, labor standards, hazard waste disposal, and air quality. For 6% of the respondents which employed more than 500 workers, 71% regarded government regulations as very important and of those 42% ranked air quality as the most important of government regulatory laws. In fact, the ranking of air quality as the most important of government regulations falls rapidly as the firm size increases.

We should also point out that, while less likely, response bias could also work in the other direction. As an example, if small firms are most harmed by air regulations, but also have fewer resources to fill out complicated questionnaires such as ours, these firms might respond less frequently, causing negative impacts to be underreported.

Because of these potential bias problems and the low response rate, we believe that the main focus of the results of this survey should be in comparing the responses of firms within the sample to one another. As an example, we might find that, among the firms that answered the survey, small firms are more concerned about cost impacts than are large firms. Thus, the general trends represented by the results are useful for policy analysis but the actual numbers should not be interpreted too literally.

Table 6.2

Correctly answered cost of compliance questions

	New Capital	Retrofit Capital	Additional Labor Costs	Additional Operational Costs
Percentage Answering Correctly	20%	13%	25%	26%

As an example of the extent of non-response, of those who answered the new capital cost question accurately, only 38% of these firms also answered the retrofit question correctly, 56% answered the operational cost question correctly and 62% answered the labor cost question correctly. Of all the 254 responding firms, only 7 answered all four compliance questions accurately and completely.

It is important to note that these responses were received after persistent follow-up mail and telephone contacts. Unfortunately, these response patterns reveal the extent of reluctance firms felt at providing quantitative responses to compliance cost estimates either by personal contact over the phone, or by anonymous survey. Of course, a fair number of firms perhaps did not know the answers or were simply unwilling to spend the time to provide answers to these rather intrusive questions.

In light of the unsatisfactory response to these questions no attempt was made to directly estimate cost of compliance for air quality using this data.

6.3 Who is Most Concerned about the Impacts of Air Quality Regulations?

Air pollution regulations do not affect all firms the same. Some firms are more heavily regulated than others. Likewise, some firms are more vulnerable to cost increases than others.

These vulnerable firms may be less able to pass their costs along to consumers or they may operate in more cost-competitive segments of the market. Among firms that cannot pass their costs along easily, some may be better equipped to absorb cost increases than others.

We asked firms to rank the importance of air pollution controls relative to other forms of government regulation often identified as important. Of particular importance, we asked firm managers to rank the importance of air quality regulations relative to state health and safety regulations and workers' compensation programs—programs that many observers of the California economy have identified as posing a real competitive challenge to the state's businesses.

The responses on relative importance of air quality regulations were separated according to type of firm. Table 6.3 shows the percentage of responding firm managers who ranked air quality regulations as being of greater importance to their business than either health and safety regulations or other labor standards such as workman's compensation, affirmative action regulations, etc. Overall, 46% of firms responding ranked air quality regulations as having greater importance to their business than health and safety or labor standards. Again, this number should be interpreted in light of the large error interval on the population estimates, but it may be used as a base for comparison among firms within the sample.

6.4 How Do Perceptions Of Pollution Regulations Vary By Firm Size

In general, one might expect small firms to find environmental regulations more troublesome than large firms, but do these small firms also find labor regulations to be more difficult? Economists disagree on precisely what constitutes a small firm. The U.S. Small Business Administration considers establishments with less than 500 employees to be small. In Europe and Japan, many of these same firms would be considered large. As an example, the international Organization for Economic Cooperation and Development (OECD) uses a cutoff of 100 employees.

To accommodate these different definitions, we examined survey responses across several different firm sizes. As expected, smaller firms rank air quality regulations as being more burdensome than do large firms. Surprisingly however, this is only true up to a point. For firms over 500 employees—i.e., those firms that most researchers agree unambiguously to be large firms—firm managers rank air regulations as more troublesome 52% of the time, well above the norm for all firms. Likewise, for firms under 100 employees--firm managers also rank air quality regulations as more troublesome than labor regulations more frequently than is the norm. Moreover, this displeasure with air quality regulations increases as the firms get smaller. It is the firms between 100 employees and 500 employees where firm managers are likely to be bothered less by air quality regulations than by labor rules. These firms represent 17% of all firms in the sample, but only 2% of all employment—the bulk of which occurs in the largest firms.

We also find that family-owned firms are more concerned over air quality regulations than are corporations (One minor problem with the survey is that it is not clear how family-owned corporations are included). Within family-owned firms, it is once again the case that small firms are most affected by air quality regulations vis-à-vis other forms of regulation. Very small family firms rate air regulations most severely. Partnerships are least likely to rank air pollution regulations as having much impact on their business.

Within corporations, headquarters are more likely to rank air quality regulations severely than are branch plants or subsidiaries. Branch plant and subsidiary managers are far less likely than managers of other types of firms to rate air regulations severely. This is important, because we know from location literature that it is these branch plants that are most likely to relocate based on regulatory considerations. Although branch plants rarely make their own location decisions independent of corporate headquarters, it seems unlikely that headquarters would relocate branches to avoid regulations when their own branch managers rate those regulatory challenges as being of secondary importance to their business.

6.5 Local versus the "National" Firms

We also examined whether firms that exported felt differently than firms that produced mainly for California markets. The literature in economics and regional economics suggests that the firms that export should have a more difficult time than those producers operating in local markets. Facing non-California competitors that are not regulated to the same degree as themselves, their costs are raised, forcing them to operate on thinner profit margins or lose market share.

Our results strongly support this view that exporters find air quality regulations more difficult than do firms operating in local markets. Indeed, a firm with less than 25% of its customers in California is twice as likely to rank air quality regulations as more troublesome than labor laws compared to a firm that has at least 75% of its customers in the state. This strongly reinforces the lesson that economic impact studies must differentiate between California markets and export markets if they are to depict accurately how the state's economy is affected by air quality regulations.

(Note that we also tried to break down the firms based on survey question 12, "where are your competitors located," but it was not possible from the responses to determine what percent of a firm's competition was inside/outside the state).

We also looked at how fast growing firms viewed air regulations relative to slow growing firms. There are at least two possibilities. On the one hand, many authors have argued that fast growing firms are most likely to be subject to stricter requirements such as technology standards under New Source Review.

Table 6.3

Percentage of Firms Ranking Air Regulations as More Important to their Business than Labor Regulations

Type of Firm	Percentage of Firms
All Firms	**46%**
Firms with:	
$n \geq 500$ employees	52%
$100 \leq n < 500$ employees	40%
$n < 100$ employees	47%
$n < 20$ employees	53%
By type of Firm:	
Family Owned	60%
fewer than 20 employees	70%
Partnership	26%
Corporation	40%
Headquarters	44%
Branch or Subsidiary	33%
Firms with n% of Customers in CA	
$n \leq 25\%$	94%
$75\% < n \leq 100\%$	46%
Firms with 1990-1993 sales growth:	
less than 0	32%
greater than 20%	50%
Firms with 1990-1993 Employment Growth	
less than 0	42%
greater than 20%	50%
Firms Producing Standardized Products	56%
Firms Producing Non-Standardized Products	22%

On the other hand, fast growing firms are presumably healthier firms, better able to support added regulatory costs than their slower growing counterparts. Measuring growth either in terms of employment or sales, our results suggest that faster growing firms do indeed find air regulations more burdensome.

Finally, we examined how producers of standardized products felt about regulations compared to producers of specialty products. Many authors have suggested that producers of specialty products are likely to operate in less cost-competitive segments of the market, relying more on subtle distinctions in product quality to distinguish themselves from their competitors. Presumably, these producers are better able to absorb or pass along cost increases than producers of standardized products, many of whom operate on very narrow profit margins. Indeed, we find that producers of nonstandardized products are far less likely to name air pollution controls as a problem relative to other regulations than are producers of standardized products.

To summarize, those firms most likely to rate air pollution controls harshly relative to other types of government regulation (specifically labor laws) include rapidly growing, very small or very large firms, family-owned firms, firms competing heavily in markets outside California, and mass producers of standardized products. Firms least likely to rate air pollution regulations harshly are slow growing partnerships or corporations, especially branch plants, firms having 100-500 employees, firms competing mainly in local markets, and especially producers of nonstandardized goods.

6.6 Which Aspects of Regulation Affect Firms Most Seriously?

Air quality regulations do not affect firms solely by making them incur costs for pollution control equipment. There are also indirect costs. An example would be the cost of transporting and disposing of wastes removed by pollution control. Pollution control efforts also may affect product quality and marketing efforts. Likewise, regulations may affect the flexibility of producers to rapidly shifting markets, output levels and technologies. Finally, pollution controls

may implicitly impose output limits by limiting allowable emissions. Which of these impacts are most important varies depending on the nature of the firms in question. Understanding which kinds of firms are affected by different aspects of regulation is critical to designing policies best suited to the needs of local firms. As an example, policies required to increase producer flexibility may be very different than those that seek to help lower costs to mass producers.

In order to address these issues, we asked firm managers to rate the importance of several types of regulation-induced impacts to their business (Survey Question 21). As an example, managers could tell us whether costs associated with purchasing and maintaining control equipment were "very important," "somewhat important," or "not important." As before, when tallying responses, we count only those firms that responded to a question.

Table 6.4
How Air Quality Regulations Affect Firms

	All Firms Responding to Question		
Impact Category	**Very Important**	**Somewhat Important**	**Not Important**
Direct Costs	62%	26%	12%
Indirect Costs	47%	37%	19%
Markets	44%	22%	34%
Input Mix	29%	30%	41%
Flexibility	40%	22%	38%
Output	44%	28%	28%

In table 6.4 we can see that, among those that answered the questions, firms rated cost impacts of air pollution regulation as being most important, with direct costs being perceived as somewhat more important than indirect costs (e.g., waste disposal and transportation). Overall, 88% of all firms responding rated direct cost impacts as somewhat or very important to their business. Again, due to large band on errors, we expect that this overstates the real seriousness of the problem, but we do not know by how much. Next in importance behind

costs were the impact of air quality regulations on output and market development, followed by impacts on producer flexibility and input mix.

6.7 Cost Impacts

Direct costs include such items as investment in pollution control equipment, operation and maintenance of that equipment, and expenses for additional labor associated with the pollution control effort. Indirect costs include such items as storage and transport of hazardous materials resulting from pollution control activities. Table 6.5 shows the percentage of firms that ranked direct and indirect costs associated with pollution control as "very important" to their business. We chose not to include percentages on the "somewhat important" responses for two reasons. First, in almost every category for both direct and indirect costs, firms were more likely to rank costs as very important than they were to call them somewhat important, so most responses are captured by looking at just the "very important responses." Second, in almost every case, the "somewhat important" responses simply confirm the conclusions drawn from examining the "very important" responses. As a result, it was possible to simplify the table and make it easier to read by examining only the responses where firms ranked costs as very important. In cases where including the "somewhat important" responses clarifies ambiguity or contradicts an apparent trend, a discussion follows.

Table 6.5

Firms Ranking Direct and Indirect Cost Impacts as Very Important to their Business

Type of Firm	% of Firms Ranking Costs as *Very* Important	
	Direct Costs	Indirect Costs
All Firms	62%	47%
Firms with:		
$n \geq 500$ employees	65%	47%
$100 \leq n < 500$ employees	58%	54%
$n < 100$ employees	63%	45%
$n < 20$ employees	68%	49%
By type of Firm:		
Family Owned	69%	53%
fewer than 20 employees	70%	57%
Partnership	80%	42%
Corporation	56%	45%
Headquarters	27%	43%
Branch or Subsidiary	64%	47%
Firms with n% of Customers in CA		
$0<n \leq 25\%$	52%	68%
$75\% < n \leq 100\%$	19%	33%
Firms with 1990-1993 sales growth:		
less than 0	80%	64%
greater than 20%	55%	43%
Firms with 1990-1993 Employment Growth		
less than 0	66%	52%
greater than 20%	56%	44%
Producers of Standardized Products	68%	52%
Producers of Non-Standardized Products	60%	70%

Overall, 62% of responding firms ranked direct costs and 47% of responding firms ranked indirect costs associated with pollution control activity as very important to their business. In several key ways, concern over control-induced costs followed the same patterns we saw earlier when firms were asked to rank the importance of air pollution controls relative to other governmental regulations. Direct costs show the same bipolar response observed earlier with respect to firm size. Thus, firms over 500 employees in size and firms under 100 employees in size both showed greater concern for direct cost impacts than did all firms as a group (although the differences are not large). Also, as they did for pollution controls in general, family-owned operations ranked direct costs as more bothersome than did most other firms. By and large, we also see that firms operating in export markets are more cost-conscious than firms that produce almost exclusively for local markets. Also, at least for direct costs, producers of standardized products (i.e., mass producers) are more cost conscious than producers of non-standardized products (i.e., flexible producers). However, this result should be taken with caution, because only a very small number of firms that answered this question actually identified themselves as flexible producers.

There were also several genuine surprises in the survey results. Most important among these is the fact that slow growing firms view costs of regulations as being more important to their business than do fast growing firms. This response holds regardless of whether one looks at employment growth or sales growth. As the previous discussion pointed out, fast growing firms are much more concerned about pollution controls than are slow growing firms. The logic given for the previous result was that fast growing firms are more likely to be stringently regulated. However, the finding that slow growth firms are more cost-conscious is also consistent with the findings of some economists. According to this view, declining firms often attempt to remain competitive through fierce "rationalization" or cost-cutting. Thus, any cost increases can be quite detrimental to these firms. Can these two views be reconciled? Yes—if there is some other factor of regulation besides costs that is bothering the fast growing firms. We will come back to this later.

Another surprising result was that 80% of the partnerships interviewed responded that direct costs were very important. This is perplexing, given that these firms had ranked pollution

controls low on their list of concerns overall. This is more difficult to reconcile than the case of slow-growing firms, and at least raises the possibility that firms are manipulating their responses. However, it is not clear why partnerships would bias their answers in a manner not seen among other types of firms. One other possibility is that these firms simply are subject to several adverse regulatory forces simultaneously. In this case, air quality regulations might be very important to the cost structure of partnerships, but less important than labor laws, which may be imposing even more severe damage. The responses of these firms deserve further exploration.

The responses of corporations also deserve some explanation. As was the case earlier, corporations, taken as a whole, are less bothered by cost increases from regulation than are other firms. However, in dramatic contrast to our earlier results, branch plants are far more bothered by cost impacts than are headquarters. Barring widespread manipulation of survey responses, this suggests again that there may be other types of impacts at work that bother headquarters, even though cost impacts are not too severe.

6.8 Product Quality and Output Impacts

In addition to raising production costs, pollution controls can also affect the ability of producers to offer quality products to their customers on a reliable basis. To assess the seriousness of this problem, we asked managers to rate the importance of air pollution regulations on market development and product quality. We also asked managers to rate the importance of those same regulations on product output more generally. This was intended to give managers greater latitude to include other kinds of impacts not picked up by the first question, including possible restrictions on output levels or reliability of delivery. The results of this part of the survey are summarized in Table 6.6.

Table 6.6

Impact of Air Quality Regulations on Product Quality and Output

Type of Firm	% of Firms Ranking Demand Variable as *Very* Important	
	Product Quality	Output
All Firms	44%	44%
Firms with:		
n ≥ 500 employees	43%	52%
100 ≤ n < 500 employees	39%	35%
n < 100 employees	46%	47%
n < 20 employees	47%	55%
By type of Firm:		
Family Owned	41%	54%
fewer than 20 employees	39%	58%
Partnership	55%	63%
Corporation	44%	36%
Headquarters	40%	34%
Branch or Subsidiary	49%	36%
Firms with n% of Customers in CA		
0<n ≤ 25%	50%	39%
75% < n ≤ 100%	44%	46%
Firms with 1990-1993 sales growth:		
less than 0	46%	47%
greater than 20%	45%	45%
Firms with 1990-1993 Employment Growth		
less than 0	48%	38%
greater than 20%	40%	50%
Producers of Standardized Products	40%	51%
Producers of Non-Standardized Products	56%	56%

Overall, 44% of responding firms rated product quality impacts as very important to their business. An identical percentage of firms rated output impacts as very important. The percentage of firms viewing product quality impacts as very important is largely unaffected by firm size. Surprisingly, small family firms were less likely to rank these market impacts as being critical. One possibility is that family firms are less heavily regulated than other firms. This could be reconciled with our earlier results on costs if small family firms were more cost conscious than other firms, even though they are less heavily regulated. Another possibility is that small family firms serve markets where competition is based more on cost than on quality.

As with costs, partnerships respond that they are more affected by quality impacts than are other types of firms. We also find that branch plants and subsidiaries are far more concerned with product quality impacts than are headquarters. Possibly, this is because subsidiary and branch plants are more immediately concerned with issues of product quality in general than are headquarters.

Firms that export appear to be significantly more affected by product quality impacts than are firms that produce mainly for California markets. This raises the possibility that California regulations may hurt product quality vis-à-vis regulations in other states, but we cannot be certain. Another possibility is that California's export mix just happens to include products where quality-based competition dominates price-based competition. This deserves further study.

Although it appears that firms with rapid employment growth are less concerned about quality impacts than are slow growing firms, both of these figures are very close to the norm for all firms, making conclusions difficult. Finally, we see that producers of non-standardized products are far more concerned with regulatory impacts on product quality than are producers of standardized products. This was to be expected.

If these results seem tentative and somewhat confusing, the results for the output question are even more so. Some of this may result from the fact that our question could have been worded more clearly. As a result, it is difficult to interpret the responses. The variability of

responses among firms was greater for this question than for any of the others, suggesting that respondents may have interpreted the question in different ways. As with direct cost impacts, mid-sized firms are less concerned about output impacts than either large firms or very small ones. Partnerships were more concerned with output impacts than they were with product quality impacts. On the other hand, corporations were less concerned about output impacts than the norm. Heavy exporters were less concerned about output impacts than their non-exporting counterparts, although the relationship is not strong. One possible explanation for this is that exporters are more likely to be engaged in multiple sourcing operations. If true, then changes in output levels due to California regulations could possibly be offset by shifting orders to non-California producers within the sourcing network. This could only be determined through very detailed interviews.

6.9 Flexibility Impacts

Air pollution controls may also affect businesses by making it difficult for them to respond to changes in markets or to alter their production methods in order to achieve greater efficiency. There were two questions on the survey designed to elicit answers regarding these impacts. First we asked managers to assess the importance of regulatory impacts on their ability to use and switch among the inputs of their choice. Second, we asked producers to assess the importance of regulatory impacts on their ability to respond to customer needs and shift between markets. Together, these questions were intended to capture issues of flexibility on both the input side and the market side. Intuitively, we should expect that barriers to flexibility are most important to those so-called "flexible producers" operating in transient markets, or where technological change is rapid. We do not know, a priori, whether these are small firms or large. Nor do we know whether these markets are local or export-based. Finally, we do not know if there is any clearly superior form of corporate organization for these firms.

The responses of managers who ranked these impact as very important to their businesses are summarized in Table 6.7. Overall, 29% of responding firms ranked input mix impacts as very important, and 40% of responding firms ranked producer flexibility impacts as

important. Both of these figures are well below the figures cited earlier for direct and indirect cost impacts. In general, we also find relatively little variation in the responses among firms. There are only a handful of responses that vary from the norm for all firms by as much as five percentage points. This suggests that barriers to producer flexibility are not likely to be a major reason why some firms are more bothered by pollution controls than other type of firms.

If we go all the way to the bottom of the table we can see that, as expected, producers of non-standardized products are far more likely than the average firm to rank input mix impacts of air regulations as very important to their business. However, this result is not reflected in the responses to the question on market flexibility. This could be either a spurious result, because only nine firms answered the question as flexible producers. Alternatively, it could be that the flexibility challenges facing these firms were on the supply side and did not affect the ability of firms to pursue flexible marketing strategies.

The other major findings are with respect to corporate organization. Firms organized as partnerships were far more likely to rank air quality regulations as a serious impediment to market-side flexibility than other firms. We have no explanation for this result. One very interesting result from the survey was that branch plants and subsidiaries of corporations were far more likely to be seriously affected by regulatory impacts of supply-side flexibility than were headquarters. One possible reason for this is that headquarters are less likely to be involved in direct production activities. Thus, when a pollution authority imposes an air quality regulation on a firm, implementation of that rule is passed along to lower level production units and it is there—not at headquarters—where the strongest impacts are felt. This is only speculation. Again we find that market side flexibility and supply side flexibility play very different roles. Branch plants are actually less affected by market-side barriers to flexibility than are headquarters.

Table 6.7

Percentage of Firms Ranking Input Mix and Flexibility Impacts as Very Important to their Business

Type of Firm	% of Firms Ranking Flexibility as *Very* Important	
	Input Mix	Producer Flexibility
All Firms	29%	40%
Firms with:		
n ≥ 500 employees	25%	43%
100 ≤ n < 500 employees	33%	39%
n < 100 employees	27%	38%
n < 20 employees	27%	37%
By type of Firm:		
Family Owned	27%	41%
fewer than 20 employees	30%	40%
Partnership	30%	59%
Corporation	28%	36%
Headquarters	17%	38%
Branch or Subsidiary	47%	33%
Firms with n% of Customers in CA		
0<n ≤ 25%	24%	44%
75% < n ≤ 100%	28%	39%
Firms with 1990-1993 sales growth:		
less than 0	27%	35%
greater than 20%	33%	50%
Firms with 1990-1993 Employment Growth		
less than 0	26%	39%
greater than 20%	23%	44%
Producers of Standardized Products	28%	43%
Producers of Non-Standardized Products	71%	44%

This is consistent with a hierarchical corporate model in which headquarters have primary responsibility for marketing while subsidiaries and branch plants have responsibility for production. However, much more research would have to be done before we could confirm this result.

The importance of air quality regulations to both supply side and demand side flexibility seems to be relatively unaffected by firm size. However, firms experiencing rapid sales growth are much more likely than other firms to express difficulty with regulatory impacts on their ability to meet changing customer needs and adjust to market shifts. This makes sense: fast growing firms are already more likely to be at the limits of their existing capacity and facing difficulties in meeting changing customer needs. Any further constraints in these areas are likely to be hard felt by such firms, and pollution control agencies routinely place stricter requirements on new and expanding firms. Somewhat surprising though is the fact that this same pattern is observed only weakly among firms with rapid employment growth. Especially in recent years, where firms have been very hesitant to take on new workers, we might expect that firms with rapid employment growth are experiencing even more rapid sales growth, suggesting that employment growth should show an even stronger pattern than sales growth. In fact, this was not the case. Upon further examination of the data it was discovered that fewer than one-third of the firms having rapid employment growth also recorded fast sales growth. On the supply side, firms with rapid employment growth are less likely to rate input flexibility as a very important problem of air pollution controls. There is no clear explanation for this.

6.10 Summary by Type of Firm

Having considered overall impacts and then specific impact categories, let us now consider the two together. This will allow us to see where the specific problems are most likely to lie for firm types that are most likely to rank air pollution controls as a serious problem. It also acts as something of a consistency check. If, for instance, a given type of firm claims to be seriously hurt by air regulations, but never identifies any particular problems, we should be

skeptical. Finally, this analysis will allow us to see if specific firm types have certain categories of impacts that they are most vulnerable to.

Table 6.8 is a summary table of economic impacts by type of firm. In each cell:

++ indicates that firm type identifies a serious problem with a frequency 10 percentage points above the norm for all firms

+ indicates that firm type identifies a serious problem with a frequency 5-9 percentage points above the norm for all firms

- indicates that firm type identifies a serious problem with a frequency 5-9 percentage points below the norm for all firms

-- indicates that firm type identifies a serious problem with a frequency 10 percentage points below the norm for all firms

As an example, in the overall impact column, "++" for family-owned firms indicates that these firms were far more likely to rank air pollution regulations as a greater problem than either labor laws or health and safety regulation (60% of the time as opposed to 46% of the time for all firms, for a spread of 14 percentage points). Similarly, a "-" in the product quality column for firms between 100 and 500 employees in size indicates that these firms ranked product quality problems as "very important" with lower frequency than all firms (39% of the time compared to 44% of the time for all firms, for a spread of 5 percentage points).

Table 6.8

Summary of Impacts by Firm Type

Firm Type	Overall Impact	Direct Costs	Indirect Costs	Product Quality	Output	Input Mix	Flex-ibility
Firms with:							
n ≥ 500 employees	+				+		
100 ≤ n < 500 employees	-		+	-	-		
n < 100 employees							
n < 20 employees	+	+			++		
By type of Firm:							
Family Owned	++	+	+		++		
fewer than 20 employees	++	+	++	-	++		
Partnership	--	++	-	++	++		++
Corporation	-	-			-		
Headquarters	-	--			--	--	
Branch or Subsidiary	--			+	-	++	-
Firms with n% of Customers in CA							
0<n ≤ 25%	++	--	++	+	-	-	
75% < n ≤ 100%		--	--				
Firms with 1990-1993 sales growth:							
less than 0	--	++	++				-
greater than 20%		-					++
Firms with 1990-1993 Employment Growth							
less than 0			+		-		
greater than 20%		-			+	-	
Firms with Standardized Products	++	+	+		+		
Firms with Non-Standardized Products	--		++	++	++	++	

The clearest results for table 6.8 relate to the plight of family firms, especially small ones. For both cost categories and for output, these firms consistently indicate greater problems with air pollution controls. This is reflected in their overall dislike of air pollution controls shown in the overall ranking. A similar pattern is seen for firms producing standardized products. A weaker, but similar result is found for small firms in general. Presumably, there is significant overlap between the small family firm population and small firms in general. A similar pattern is also present for those firms with over 500 employees, but output impacts seem to be more serious than cost impacts.

On the other side of the coin, incorporated firms, and especially headquarters, are far less likely than other firms to identify either specific or general problems with air pollution controls. Again, it is the direct cost and output categories that seems to be the most important. Ironically, several firm categories that rate pollution controls as a serious problem most infrequently also indicate that they are severely impacted in specific categories. Most obvious among these are partnerships and specialty producers, which are far more likely to identify pollution controls as a major influence on their business in several categories; yet these same firms do not view pollution controls as anywhere near as serious a problem as labor laws and health and safety regulations. A similar, but weaker pattern is also seen for branch plants and subsidiaries, and for firms with slow sales growth.

The effect of exporting is unclear. On the one hand, firms that produce mainly for California markets are clearly less concerned than other firms about cost impacts. On the other hand, the cost impacts on firms that export heavily are mixed, and these exporters seem to be less concerned about several other potential impacts of air pollution controls, even though they rank air pollution controls in general as a serious matter. The effect of firm growth is also unclear. Slow growing firms do seem to be more concerned about the cost impacts of pollution controls than other firms, but that is about as far as we can go.

In addition to the quantitative responses described above, the firms were asked a set of open-ended questions to provide more detailed answers and the opportunity to elaborate.

Many of these comments indicate the high level of resentment, noted earlier, with having to comply with the regulations. Additionally, these comments provided further insight toward each of the specified impact categories, i.e., direct costs, indirect costs, output impacts and others.

When examining the comments on the impact of air quality on direct costs the following aspects dominate in order of importance: (1) retrofitting costs especially those associated with purchase and maintenance of equipment (2) record-keeping/documentation costs and (3) increases in production time. When examining the impact of indirect costs, record-keeping and possible delays are again mentioned but these are secondary to the costs associated with waste disposal, transportation, and manpower.

When asked to describe in their own words the three most important ways that air quality regulations have affected their businesses (Question 20) the following categories were listed most frequently: (1) reduced level of production (2) high costs associated with record-keeping (3) product quality (4) production costs (especially those for retrofitting equipment purchase and maintenance) and disposal costs.

The open-ended questions support the quantitative responses in general but given the limited number of responses it is not possible to associate clearly these comments to various firm classifications. It is clear that record-keeping, waste disposal and retrofitting are considered to be the three most significant issues. The frequent mention of waste disposal (and perhaps accompanying record-keeping expenses) suggests that those industries where such waste disposal activity is required are some of the industries most impacted by these regulations. Another possibility is that in spite of clear guidelines contained in the survey instrument, given the opportunity to express their views, the firms are commenting on their concerns over all the regulations (including, for example, those dealing with disposal of toxic wastes) they are subject to rather than only the air quality issues.

The firms were asked questions about location and relocation in the last section of the survey. The scope of the project did not extend to the firms which have moved out of the state, a pool that ought to be investigated. However, we did review the data that Los Angeles

Economic Development Corporation has collected on such firms. Unfortunately, the data do not contain information on the reasons these firms moved out. In Chapter 2 we have reviewed relevant results of other surveys.

Table 6.9 provides summary of the survey data questions on location.

Table 6.9

Regulation and Location Factors for Surveyed Firms

Moved in the last three years	5
Intend to relocate in the next 15 months	41
Mentioned regulation as important in location decision	18
Mentioned air quality regulation important in location decision	3

Of the firms which responded to the survey, only five had moved in the last three years. Forty one indicated that they intended to move in the next fifteen months.

When asked to mention three most important factors in their location decision, thirty six of the forty one firms which said that they intended to move provided such information. Their comments are provided as Appendix E.

Of these thirty six firms, eighteen indicated that regulations would be an important factor in their location decision. But only three of these eighteen firms clearly mentioned air quality regulations as an important location determinant.

The results on location and relocation preference need to be interpreted very cautiously since an indication of preference for relocation is not the same thing as an actual move. More study is needed before any conclusions should be drawn.

The individual firm response pattern, as shown in Table 6.10, is very similar to that for other questions. Medium size firms (employees between 100 and 500), partnerships, and slow growing firms indicated greater preference to move than other categories. Interestingly enough exporting seems to have little impact on the desire to move.

Table 6.10

Preference for Relocation

Type of Firm	Moved in the Last Three years	Plan to Move in the Next 15 Months
All Firms	5	41
Firms with:		
n ≥ 500 employees	6.0%	12.1%
100 ≤ n < 500 employees	2.3%	23.3%
n < 100 employees	1.1%	15.2%
n < 20 employees	1.8%	9.8%
By type of Firm:		
Family Owned	3.0%	12.0%
fewer than 20 employees	0%	8.0%
Partnership	0%	25.0%
Corporation	2.2%	18.3%
Headquarters	1.2%	18.4%
Branch or Subsidiary	4.8%	17.1%
Firms with n% of Customers in CA		
0<n ≤ 25%	4.7%	23.5%
75% < n ≤ 100%	1.3%	11.3%
Firms with 1990-1993 sales growth:		
less than 0	1.8%	14.6%
greater than 20%	2.9%	25.7%
Firms with 1990-1993 Employment Growth		
less than 0	1.2%	13.9%
greater than 20%	3.4%	20.5%

6.11 Some Caveats and Conclusions on the Cost of Compliance and Business Location

The review of the literature on air quality costs (Chapters 2 and 3), the analysis of secondary cost data (Chapter 4), and our experience with direct survey cost estimates (Chapters 5 and 6) clearly show the enormous complexity of obtaining reliable cost estimates. The same conclusion has recently been echoed by a chorus of nationally recognized researchers (Jaffe et al. 1995):

> Despite the fact that new environmental regulations typically will not cause firms to relocate *existing* plants (due to significant relocation costs), firms have more flexibility in making decision about the siting of new plants. Indeed, some environmental regulations are particularly targeted at new plants--so-called "new source performance standards."
>
> There appears to be widespread belief that environmental regulations have a significant effect on the siting of new plants in United States. The public comments and private actions of legislators and lobbyists, for example, certainly indicate that they believe that environmental regulations affect plant location choices...The evidence from U.S. studies suggests that these concerns may not be well founded. (p.148)

The authors provide a summary of their analysis on Domestic Plant Location as shown in Figure 6.11 with the conclusion that

> While these results indicate that firms are sensitive, in general, to cost variations among states when deciding where to locate new facilities, there is little direct evidence of a relationship between stringency of environmental regulations and plant location choices... (pp. 148-49).

Most economists do not share the view that environmental regulations provide a "green" free lunch by technology forcing and net job creation. At the same time the consensus of the professional opinion is that environmental regulations have not posed significant impediments to U.S. competitiveness (Jaffe et al. 1995).

Figure 6.1

(Table 9 from Jaffe et el. 1995)*
Effects of Environmental Regulations on Domestic Plant Location Decisions

Study	Time Period of Analysis	Industrial Scope	Results
Bartik	1988 1972-1978	Manufacturing branch plants of Fortune 500 companies	No significant Effects
Bartik 1989	1976-1982	New small businesses in 19 Manufacturing industries	Significant but small effects
Friedman, Gerlowski, and Silberman 1992	1977-1988	Foreign multinational corporations	No Significant effects
Levinson 1992	1982-1987	U.S. Manufacturing	No significant effects
McConnell and Schwab 1990	1973, 1975, 1979, 1982	Motor Vehicle Assembly Plants (SIC 3711)	Mostly insignificant effects

*Jaffe, Adam B., Steven R. Peterson, Paul R. Portney and Robert N. Stavins. 1995. Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence tell Us? Journal of Economic Literature. 33, March, 132-163.

At the regional level, this makes it very difficult to draw firm conclusions about the role of air quality regulations in business location decisions. In an era of increasing reliance on incentive based and other performance based environmental regulations, accurate accounting for pollution control will be an even more pronounced a problem. This is because pollution expenditures are increasingly taking the form of process changes and product reformulations rather than end-of-pipe control equipment. If delays and litigation or what business people call the "hassle factor" are the greatest impediments to plant location, these effects too are not picked up by traditional spending for control equipment. It is also very difficult to measure the effectiveness of enforcement efforts. Subtle differences in enforcement strategies can have important effects on perceptions and effectiveness of regulations.

While the previous chapters have presented a thorough discussion of our attempts at measuring the cost of air quality compliance and their micro-level impacts, we now look at the issue with a different analytical tool and examine the macroeconomic data for likely impacts of these regulations.

Chapter 7

THE IMPACT OF AIR QUALITY REGULATIONS ON THE CALIFORNIA ECONOMY

Economic theory relates costs of production to level of output via the concept of production function. As the cost of an input (clean air) rises, firms make adjustments in their production technology and input combinations. They may decide to substitute the more expensive input by cheaper substitutes to the extent such substitution is possible. The additional cost for the input and adjustments in production operations will be reflected in higher output prices, lower output or some combination of the two. The exact combination will be determined by the competitive structure of the industry, the state of technology and its adaptability, and consumer demand for the product. The process of adjustment may mean restructuring of the industry and the economy, i.e., decline or elimination of certain firms and growth of other firms and industries. The precise adjustment path is determined by interaction of very complex economic and technical processes of the affected industries (Schmalensee (1994) provides an excellent discussion of the underlying economic analysis).

In spite of the well-established economic theory of production, the empirical magnitudes of these changes can only be determined by an examination of the actual impacts of the cost changes. In particular, to measure the economic impact of air quality regulations, one needs to have estimates of accurate industry cost changes due to such regulation, output and employment effects of such cost increases and, for an overall impact, the interrelationships of industries in the economy.

Regional economic impact models are available to estimate the economic impacts of air quality regulations. These models are used by many air quality management districts in California, such as the use of the REMI Model and other analytical tools by SCAQMD. These models require the use of cost data which as discussed in Chapters 3 through 6 was not

available in this project. An alternative strategy, as outlined in the original research proposal to ARB, will now be used to get a measure of the impact of California air quality regulations on employment and business location. This strategy is to examine the economic performance of the state economy over the study period (1990-93), to delineate the job changes caused by business location decisions and to estimate the extent to which these can be attributed to air quality regulations.

The California economy is just now emerging from a long and deep recession. Between July 1990 and December 1993 the number of jobs in California fell by more than 600,000. The state's economic downturn extended well beyond the end of the national recession in mid 1991.

For most of 1992 and 1993 there were two alternative hypotheses about the reasons for California's long economic downturn. These hypotheses, which were often portrayed as competing explanations for California's job losses, can be summarized as follows.

1) California's job losses were primarily attributable to specific factors a) the national recession; b) cutbacks in the aerospace industry; c) a substantial downturn in residential construction; and d) an especially sharp drop in spending relative to income as consumer confidence fell.

2) The alternative hypothesis was that relocation of California firms to areas outside the state and lost business expansions were a major factor in total job losses. The reasons cited for this hypothesis were that California had a poor "business climate" as represented by problems in the state's workers compensation system, tax structure, implementation of environmental regulations, and complacency about attracting and retaining business.

A series of reports and studies conducted since 1990 (reviewed in Chapter 2) have suggested that environmental regulations in general and air quality regulations specifically played a role in California's job losses. The reasoning for this view is that the air quality

regulations facing firms in California have raised the cost of producing in California relative to other locations and, as a result, some firms have relocated outside the state.

For air quality regulations to have been a significant factor in California's recent job losses, two facts must be true:

1) A significant share of the state's job losses must have been the result of business climate problems

2) A significant share of the business climate induced job losses must have been related to air quality regulations

The major test of the importance of business climate issues on recent job losses is whether California's share of jobs declined in industries subject to interstate competition. Business climate problems are supposed to cause harm by reducing the share of jobs and production in industries subject to interstate or international competition.

One objective of the analysis in this chapter is to examine how much of California's job losses were the result of share losses in basic or export industries. A second objective is to examine the extent to which share losses could be attributable to air quality regulations.

The business climate studies reviewed in Chapter 2 produced some evidence on job losses from business relocations and out of state expansions. This evidence is analyzed below in light of past evidence on business relocations and in relationship to the magnitude of California's recent job losses.

7.1 Magnitude of California Job Losses

Between July 1990 and December 1993 the number of non farm jobs in California fell by 602,300. This drop represented a decline of 4.8% of the 12.5 million non farm jobs in July 1990. (This section was prepared before revised job estimates for 1993 and 1994 were published by EDD in March 1995. A preliminary assessment of the impact of data revisions on the findings reported in Chapter 7 is discussed at the end of the chapter).

A portion of the California job losses were caused by the national recession. However, most of the state's job losses occurred after the national economy had started to recover.

Table 7.1
California Jobs by Major Industry
July 1990 to December 1993 (Seasonally Adjusted; Thousands)

	July 1990	December 1993	Change
Mining	37.7	34.2	-3.5
Construction	562.3	447.1	-115.1
Manufacturing	2,069.0	1,766.1	-302.9
Transp, Pub Utilities	613.4	597.9	-15.5
Wholesale Trade	767.4	674.7	-92.7
Retail Trade	2,230.7	2,090.6	-140.1
Finance, Ins, Real Est.	810.2	780.7	-29.5
Services	3,358.6	3,469.6	111.0
Government	2,093.3	2,079.4	-13.9
Total NonAg Wage and Salary Jobs	**12,542.6**	**11,940.3**	**-602.3**

Source: California Employment Development Department

7.1.1 California Did Not Participate in the National Recovery

Jobs in California fell at the same rate as the nation during the national recession in 1990-91. Between July 1990 and May 1991 the number of jobs fell by 1.3% in both economies as shown on Figure 7.1. The national recession was a cause of job losses in California but it is not the reason California did worse than the nation.

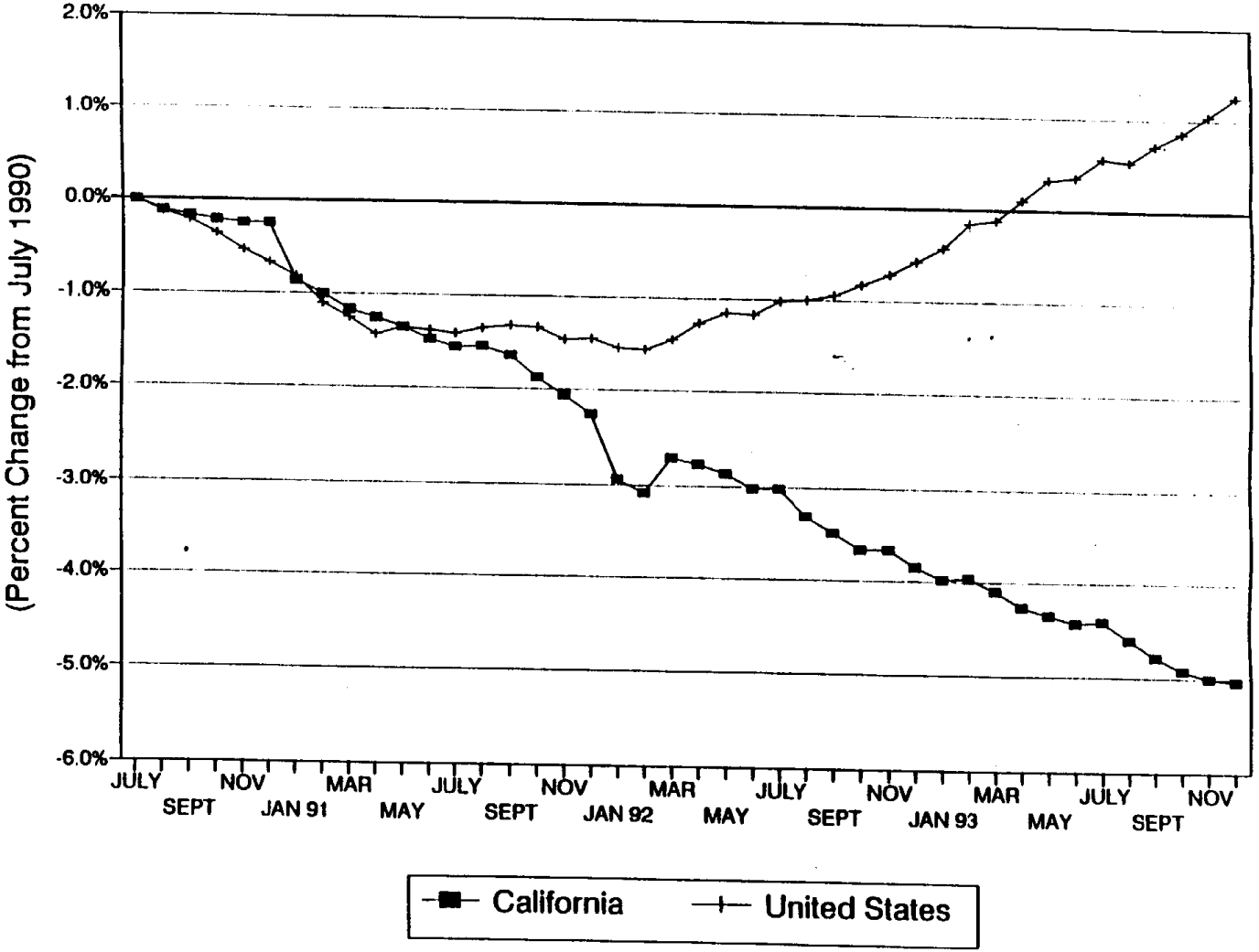
The difference in economic performance came **after** the national economy started to recover. The California economy did not participate in the nation's recovery . The state continued to experience economic declines for another 2½ years.

Between May 1991 and December 1993 the nation added three million jobs while California lost nearly 450,000 jobs.

Figure 7.1

Comparison of Job Trends

July 1990 - December 1993



7.2 Where the Job Losses Were: A Sectoral Analysis

The data show clearly where (i.e., in what industries) job losses occurred in California and where the state's job performance departed from national trends. The picture of where job losses occurred provides the basis for an explanation of why California did not participate in the nation's job recovery after mid 1991.

California's job losses were concentrated in the Construction, Manufacturing, and Retail Trade sectors. More than 100,000 jobs were lost in Construction and Retail Trade while over 300,000 jobs were lost in Manufacturing. These losses were partially offset by an increase of 111,000 jobs in the Services industry.

How did California compare to the nation in these four key sectors? California did worse than the nation in each sector.

- California experienced a 20.5% drop in Construction jobs; the national loss was half as deep at 10.2%.

- California experienced a 14.6% drop in Manufacturing jobs; the national loss was again half as large at 7.4%.

- Retail Trade jobs fell by 6.3% in the state while the sector increased slightly (1.2%) in the nation.

- Services jobs rose by 3.3% in California. However, services jobs surged by a strong 9.0% in the nation.

Table 7.2

California and United States Jobs Trends in 4 Key Sectors

July 1990 to December 1993 (Seasonally Adjusted; Thousands)

	California		United States	
	Change	Percent Change	Change	Percent Change
Construction	-115.1	-20.5%	-470.0	-10.2%
Manufacturing	-302.9	-14.6%	-1,425.0	-7.4%
Retail Trade	-140.1	-6.3%	239.0	1.2%
Services	111.0	3.3%	2,529.0	9.0%

Source: California Employment Development Department; Bureau of Labor Statistics

One focus for this project was to examine how much of the state's job decline could reasonably be attributed to location decisions (i.e., firms leaving California) and how much to other causes.

7.3 Explanation of California's Job Loss

There are four principal reasons why the California economy did so poorly while the nation was beginning to recover.

- Between 1989 and 1993 residential building fell by 2/3 in California. In contrast, by 1993 the rest of the nation had surpassed 1989 housing construction levels.

- Spending on civilian aircraft and parts fell in response to worldwide airline industry restructuring. This decline affected domestic sales, **and** caused a sharp decline in exports. Aircraft makes up above average share of the state's economy - twice the national average.

- U.S. defense spending continued to decline between 1990 and 1993 - a decline begun in 1986. The decline affected several industries in California in addition to aircraft.

- Defense related spending accounts for an above average share of the state's economy - roughly twice the national average although defense spending has declined substantially in importance in both the state and national economies.

- Retail spending in California fell by 10% adjusted for inflation. The decline was far greater than the drop in real income.

  This "extra" drop in spending in California explains part of the state's poor trends in Retail Trade and Services jobs.

7.3.1 Residential Construction

The record is clear that residential construction in California plummeted while the nation recovered. The number of residential building permits in California fell from 237,700 in 1989 to just 84,400 in 1993 - a drop of 64.5%.

During the same period residential permits issued in the rest of the country rose by 5.7%.

To understand why California trends departed from the national picture, it is helpful to look at the California housing market in 1989. Two factors stand out as shown below.

- Resale housing prices had just posted two years of double digit gains. Housing prices in California surged relative to prices in other parts of the nation, as shown on Figure 7.2.

Table 7.3

California and United States Residential Permits

(Thousands)

	1989	1993	Percent Change
United States	1,376.1	1,287.6	-6.4%
California	237.7	84.4	-64.5%
United States Except California	1,138.4	1,203.2	5.7%

Source: U.S. Department of Commerce

The surge in housing prices, which began in 1985, had allowed many homeowners to finance the purchase of new homes and had pushed new construction in 1985-89 way above the long term average.

- Housing prices in 1989 had risen so far that they were out of line with household incomes, as shown on Figure 7.3.

California's housing market was overpriced relative to income and to housing in other areas. A substantial correction was due and has been underway since 1989. The residential downturn continued despite the addition of two million residents between 1990 and 1993.

This residential building correction was magnified by the national recession, but it was not caused by the recession. California's sharp downturn was, thus, not repeated elsewhere in the nation. Similarly, the nonresidential building downturn had started in late 1988. Overbuilding had left rising vacancy rates well before the recession began.

As a result of the above factors it is likely that the amount of construction job losses attributed to relocation decisions (if they could be measured) would be very small.

Figure 7.2

Median Housing Prices

California and United States

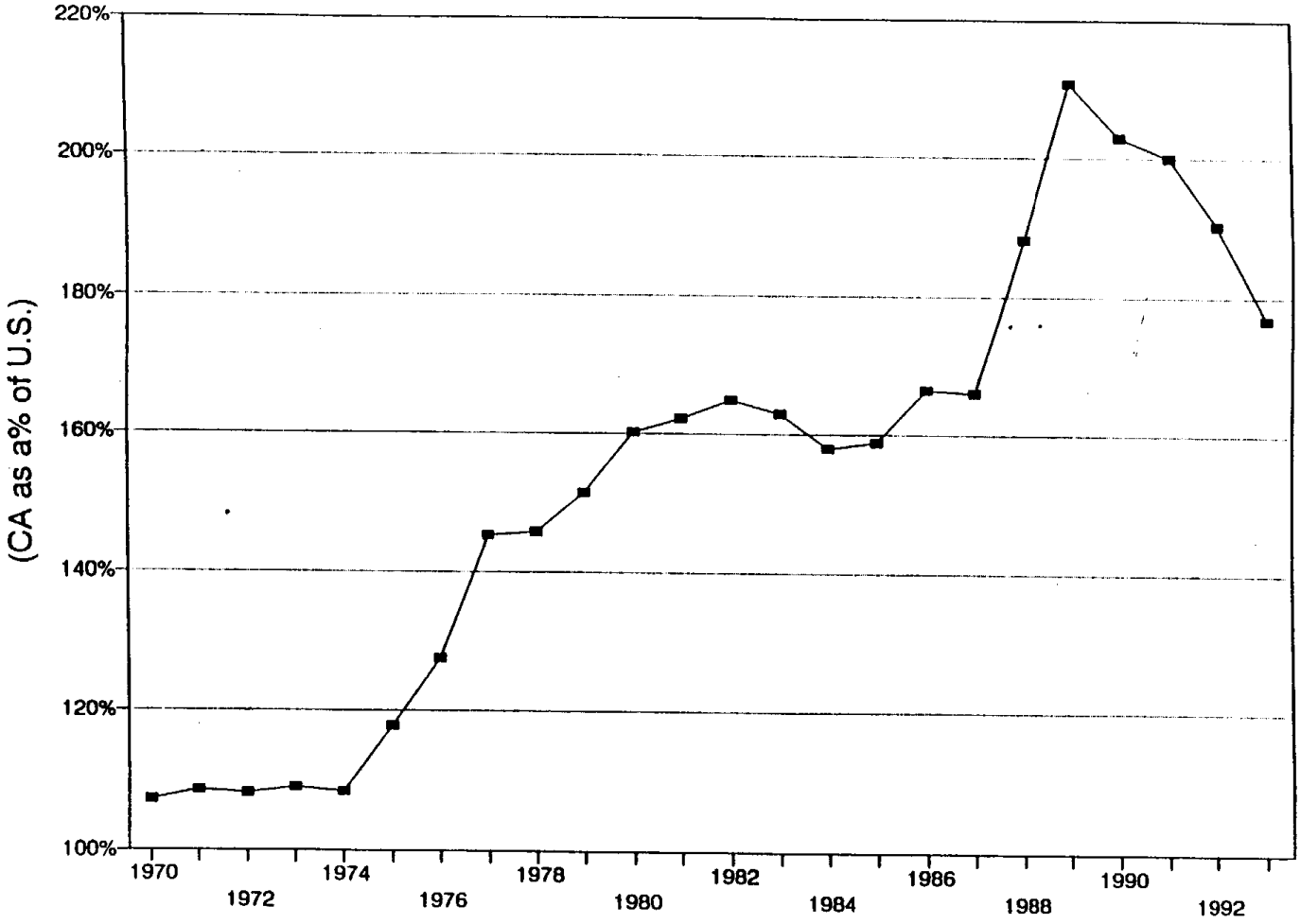
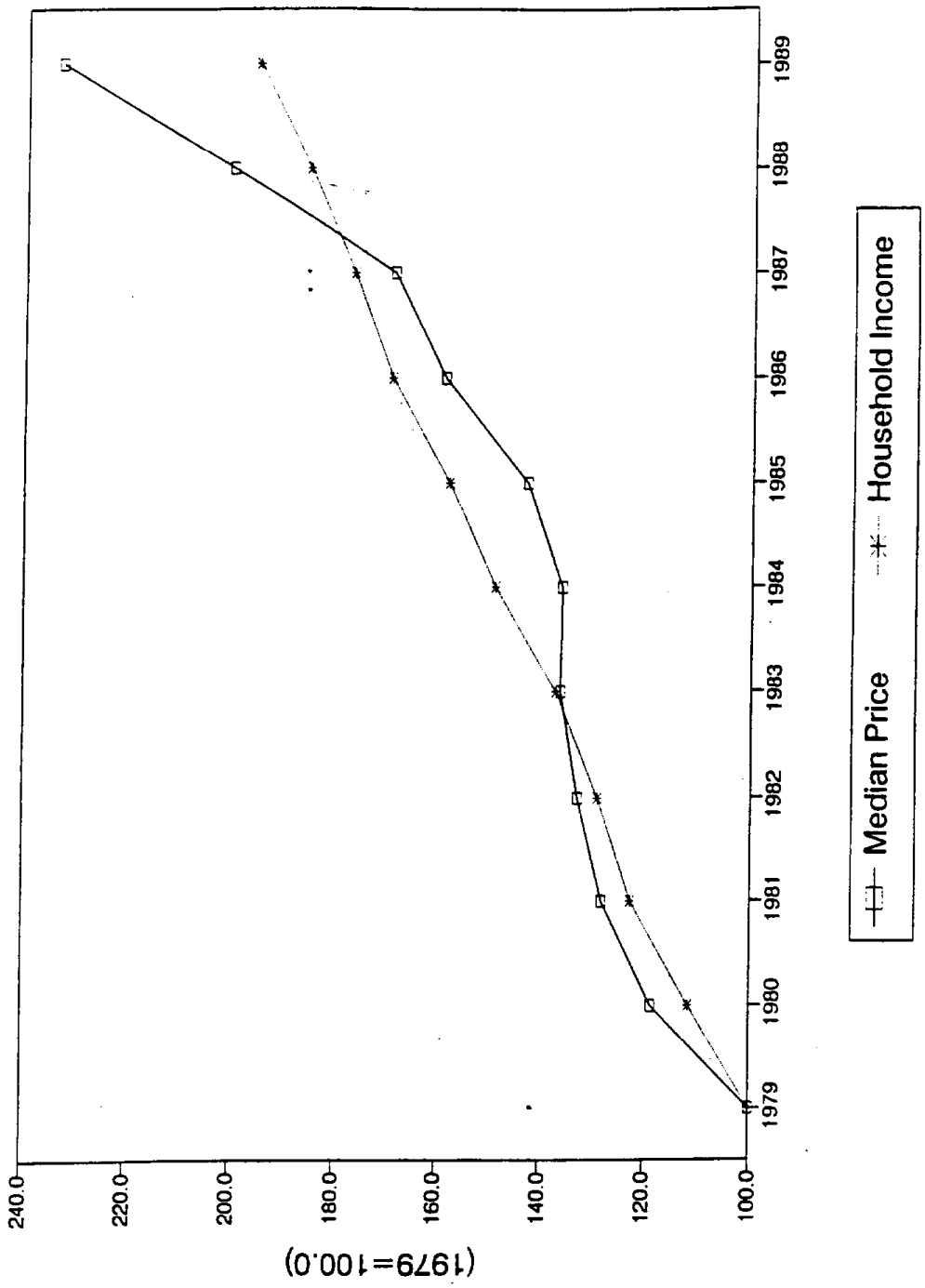


Figure 7.3
Median Home Prices vs. Income
California 1979-1989



7.3.2 Manufacturing - Where Were the Job Losses?

California's manufacturing sector has been the subject of intense discussion and controversy. Manufacturing jobs in California did fall more than in the nation. The explanation of where and why this occurred is important both for assessing future prospects in the state and providing a focus for public policy.

Two alternative explanations have been set forth to explain why manufacturing jobs fell more in California than in the nation:

- National declines in aerospace and high tech employment (two large sectors in California's manufacturing base) plus California's large decline in construction activity

- A widespread failure of the state to be competitive leading to out of state relocations and lost business expansions

The evidence is now clear that most of the manufacturing job losses are explained by specific factors in specific industries and not a general loss of manufacturing competitiveness.

The deepest losses in the manufacturing sector were in aerospace - primarily in aircraft, missiles and space, and search and navigation equipment. Over 130,000 jobs disappeared between July 1990 and December 1993 - a drop of more than one third in the size of California's aerospace manufacturing sector as shown in Table 7.4.

The aerospace job losses were primarily related to national trends. Aerospace jobs fell by over 400,000 in the nation - a drop of nearly 30% in 3½ years as shown in Table 7.6.

Table 7.4

California Manufacturing Jobs

(Thousands)

	July 1990	December 1993	Change	Percent Change
Aerospace	350.4	219.1	-131.3	-37.5%
High Tech	392.0	346.5	-45.5	-11.6%
Construction Related	177.0	134.1	-42.9	-24.2%
Other Manufacturing	1,158.2	1,062.0	-94.2	-8.3%
Total Manufacturing	2,077.6	1,761.7	-316.9	-15.2%

Source: California Employment Development Department.
NOTE: Data are not seasonally adjusted; totals do not match previous table.

California had a heavy concentration in a sector which declined everywhere in the nation. This is one piece of the story on why manufacturing jobs fell more in the state than in the nation.

It is important to understand that aerospace jobs in California and the nation fell in response to **two** trends - 1) cutbacks in commercial airline orders and exports and 2) defense spending reductions. For example, civilian orders and aircraft exports fell by roughly 20% in 1993. As shown in Table 7.5 below, civilian aircraft employment has fallen as much recently in the nation as military related jobs.

Table 7.5
United States Aircraft Employment
(Thousands)

Year	Civil	Military	Total
1986	238	401	639
1991	345	315	660
1992	322	275	597
1993 est.	265	250	515
1994 forecast	249	235	484

Source: Aerospace Industries Association

A portion of California's aerospace job losses were attributable to a decline in the share of the U.S. industry located in California. Significant out of state relocations have been announced by Lockheed, Hughes, and McDonnell Douglas. The share losses (of which only a part was the result of relocations) accounted for 26,900 of the 131,300 decline in aerospace jobs.

Construction related jobs - in wood products, furniture and stone, clay, and glass - fell by nearly 25% in response to the decline in construction spending.

The construction related industries in California serve both local and national markets. As a result, the decline in jobs was far less in percentage terms than the decline in California construction.

For furniture and wood products, the two market segments that serve some national markets, the share decline was from 9.8% of U.S. jobs in 1990 to 7.8% in 1993. If half of this loss was accounted for by the California construction slump, approximately 12,000 of the jobs lost in this sector could be attributed to long term share losses and a portion of these losses could have been the result of relocations.

High tech jobs fell by 11.6%. High tech manufacturing jobs declined at nearly the same rate in California and the nation. California's share of the national industry remained unchanged during the state's long recession.

The high tech job losses do not represent a decline in high tech production in either the state or nation. Actually, high tech sales and profits surged in 1993. The nation regained world leadership in markets like semiconductor manufacturing equipment. High tech firms in Silicon Valley reached record sales **and** profits.

The decline in jobs was caused by a rapid increases in productivity. Fewer workers are producing more sales and profits.

Table 7.6

California and United States Change in Manufacturing Jobs

July 1990 - December 1993 (Thousands)

	California		United States	
	Change	Percent Change	Change	Percent Change
Aerospace	-131.3	-37.5%	-409.7	-29.8%
High Tech	-45.5	-11.6%	-244.0	-12.1%
Construction Related	-42.9	-24.2%	-125.2	-6.9%
Other Manufacturing	-94.2	-8.3%	-595.1	-4.3%
Total Manufacturing	-316.9	-15.2%	-1,374.0	-7.2%

Source: California Employment Development Department; Bureau of Labor Statistics; Data are not seasonally adjusted.

However, because high tech is a much larger share of the state's manufacturing base, the large national job losses had more of an impact on the state's job picture.

California actually gained share in the high tech sector between 1990 and 1993 so none of the job losses are related to share declines.

The remaining portion of manufacturing, designated as Other Manufacturing on the tables, accounts for over half of California's manufacturing jobs. The other manufacturing sector includes a diverse group of industries ranging from apparel, publishing, and plastics to metal products and machinery.

These industries lost 94,200 jobs between July 1990 and December 1993 - a decline of 8.3%. The comparable industries nationwide lost 595,100 jobs - a decline of 4.3%.

California's share of U.S. jobs in other manufacturing industries did fall from 8.3% in July 1990 to 8.0% in December 1993. The share loss accounted for about 45,000 jobs lost in manufacturing statewide.

Probably several factors contributed to the share loss. Some jobs, for example, in metal products, were related to aerospace job losses. Some additional job losses were related to declines in high technology and construction markets. Some of the 45,000 jobs accounted for by share losses could be attributable to firms moving out of the state.

Industry share declines can, of course, occur for many reasons in addition to business climate and firms moving locations.

7.3.3 Trends in Income and Spending

The California recession had a substantial impact on income and spending in the state.

Total personal income did grow by 10.3% between 1990 and 1993 according to just released preliminary 1993 estimates. However, as shown on Table 7.7 when adjusted for

inflation, total income remained level over the three year period - a period in which the state gained nearly two million residents.

Total income increased more in the nation - posting a 5.1% inflation adjusted gain between 1990 and 1993. Thus California lagged the nation in income gain as shown on the table below. The state income estimates are consistent with job loss estimates for California in the 500,000 to 600,000 range.

The difference in spending trends between California and the nation was much larger.

Retail sales actually fell in California (in current dollars) between 1990 and 1993 despite a 10% gain in income. After adjusting for inflation, retail sales in California fell by over 10% while total income did not fall.

Retail spending declined sharply **relative to income** in California as shown on the Table 7.7 and Figure 7.4. Retail sales were 38.4% of income in 1990 and just 34.3% of income in 1993. By late 1993 spending in relation to income was nearly 5% lower in California as compared to the nation.

Table 7.7

California and United States Income and Spending Trends

1990-1993 ($ Billions)

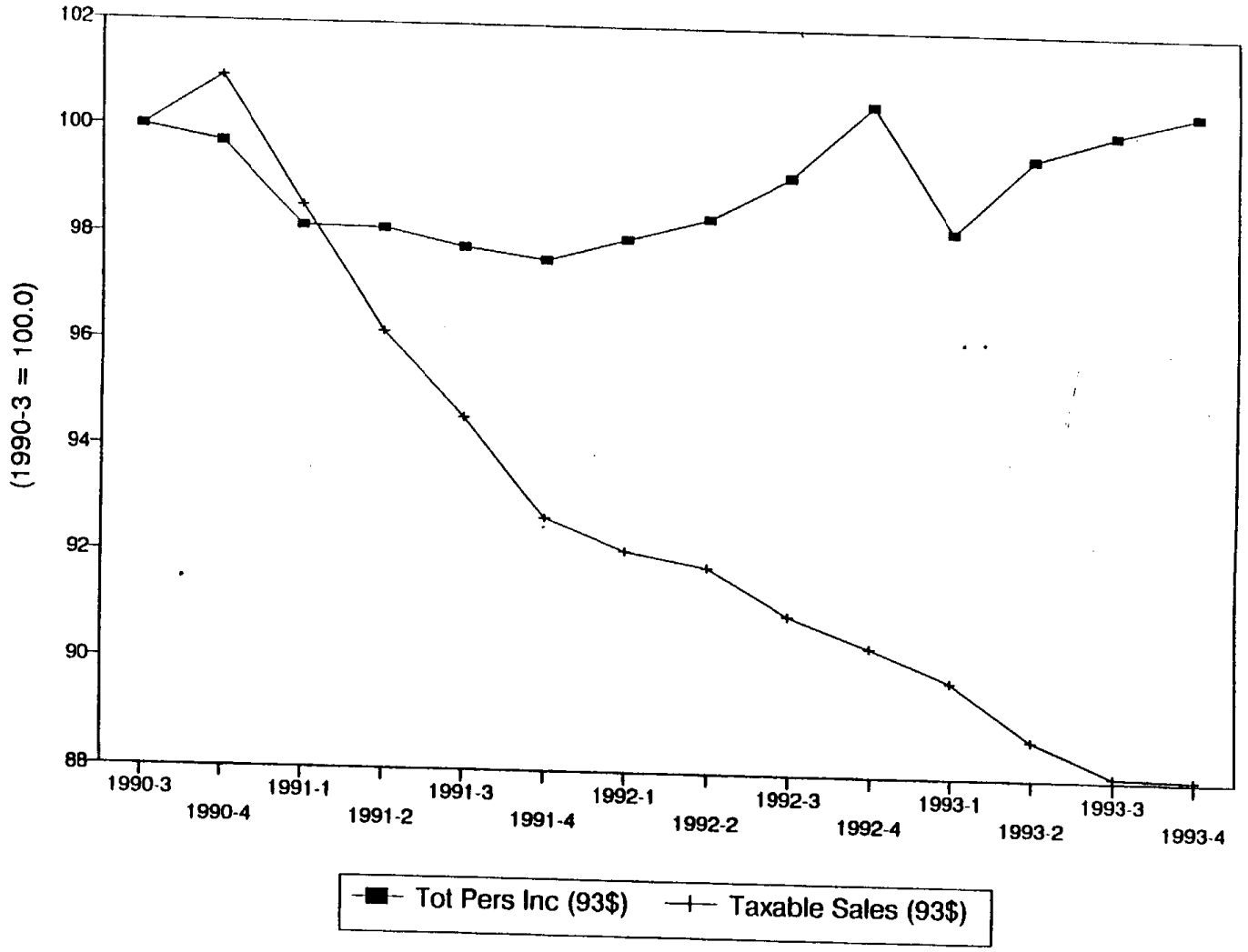
			Percent Change	
	1990	1993	1990-93	In 1993 $
Total Personal Income				
California	$617.1	$681.1	10.3%	0.5%
United States	4,655.4	5,369.0	15.3%	5.1%
Retail Sales				
California	$237.0	$233.7	-1.4%	-10.1%
United States	1,848.4	2,081.6	12.6%	2.7%
Retail Sales/Income				
California	38.4%	34.3%		
United States	39.7%	38.8%		

Source: U.S. Department of Commerce

Figure 7.4

Growth Trends In Income and Spending

3rd Quarter 1990 - 4th Quarter 1993



Why did spending lag so far behind income in California? The lag is partially explained by the different trends in consumer confidence shown on Figure 7.5. It seems as if the decline in spending necessitated for those who lost jobs carried over to many Californians who did not suffer the loss of jobs or income. Moreover the decline in California home prices may have acted as a restraining factor in retail spending.

Whatever the explanation for this trend, two points are clear.

- Spending dropped sharply relative to income in California. If spending had kept pace with even the state's poor income growth, retail sales would have been $28 billion higher in 1993 - a 10% difference in spending.

- This decline partially explains why Retail Trade and Services jobs in California did so poorly compared to national trends. The job losses caused by the recession were compounded by the additional cutbacks in spending relative to income, for example, a 10% increase in Retail Trade jobs in 1993 is equal to more than 200,000 jobs.

7.4 Job Losses Were Concentrated in Southern California

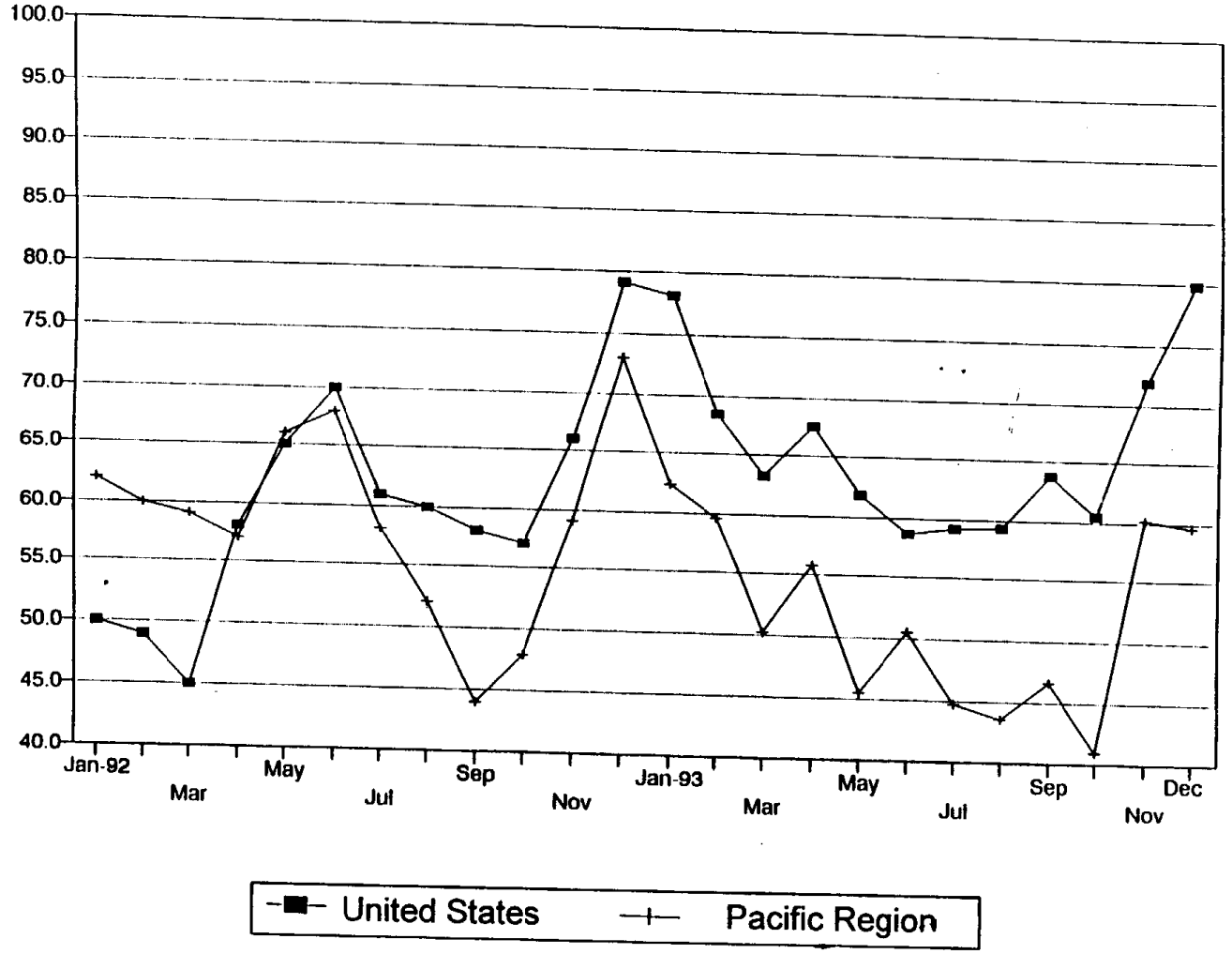
California's job losses were not distributed evenly across the state. California's job losses were concentrated in Southern California. Between July 1990 and December 1993 nearly 80% of the state's job losses were in the Los Angeles Basin as shown in Table 7.8. That region accounted for 473,500 of the state's 602,300 total job loss.

Even more striking is the fact that a single county - Los Angeles County - accounted for over 70% of California's job decline.

Two areas of the state - the Sacramento and Rest of State regions - actually gained jobs during California's long recession although job gains in each area were very small. The Bay Area lost over 100,000 jobs and accounted for 17.6% of the state's total losses.

Figure 7.5

Consumer Confidence Index



The geographical distribution of job losses strongly supports the hypothesis that specific factors, not a general and persistent deterioration in competitiveness accounted for most of the state's job losses. Los Angeles County which accounted for 70% of the job losses, was also the area most severely affected by the aerospace downturn and construction declines.

The conditions for workers compensation, environmental regulation, and state taxes are similar throughout California. Therefore the fact that different geographical areas of the state had very different job loss experiences indicates that statewide "business climate" issues were not the primary cause of California's long recession.

Table 7.8
California Job Losses by Major Region
July 1990 - December 1993 (Thousands)

	July 1990	December 1993	Change	Percent of State Change
Los Angeles Basin	6,248.0	5,774.9	-473.1	78.5%
Los Angeles County	4,130.8	3,702.3	-428.5	71.1%
San Francisco Bay Area	2,938.4	2,832.4	-106.0	17.6%
San Diego	966.4	933.9	-32.5	5.4%
Sacramento Region	622.5	623.9	1.4	-0.2%
Rest of State	1,767.3	1,775.2	7.9	-1.3%
California	12,542.6	11,940.3	-602.3	100.0%

Source: California Employment Development Department; Seasonally adjusted

7.5 Quantitative Evidence on Business Relocations

In 1992 a consortium of California public utilities sponsored the California Industry Migration Study and published estimates of the number of jobs related to relocations and expansions by California based firms to locations outside of the state. The results were based on telephone interviews and follow up questionnaires with the CEO or CFO of companies thought to have relocated/expanded outside of California. The study consultant made an extensive search to find all eligible firms.

The utility study was restricted to manufacturing firms. Most manufacturing firms are subject to interstate or international competition for location. While some non manufacturing industries (e.g., motion picture production) are subject to locational competition, most non manufacturing jobs (e.g., retail trade) serve primarily local populations.

Two sets of findings have been reported. The full survey covered the twelve year period 1980-1992 and is reported on Table 7.9.

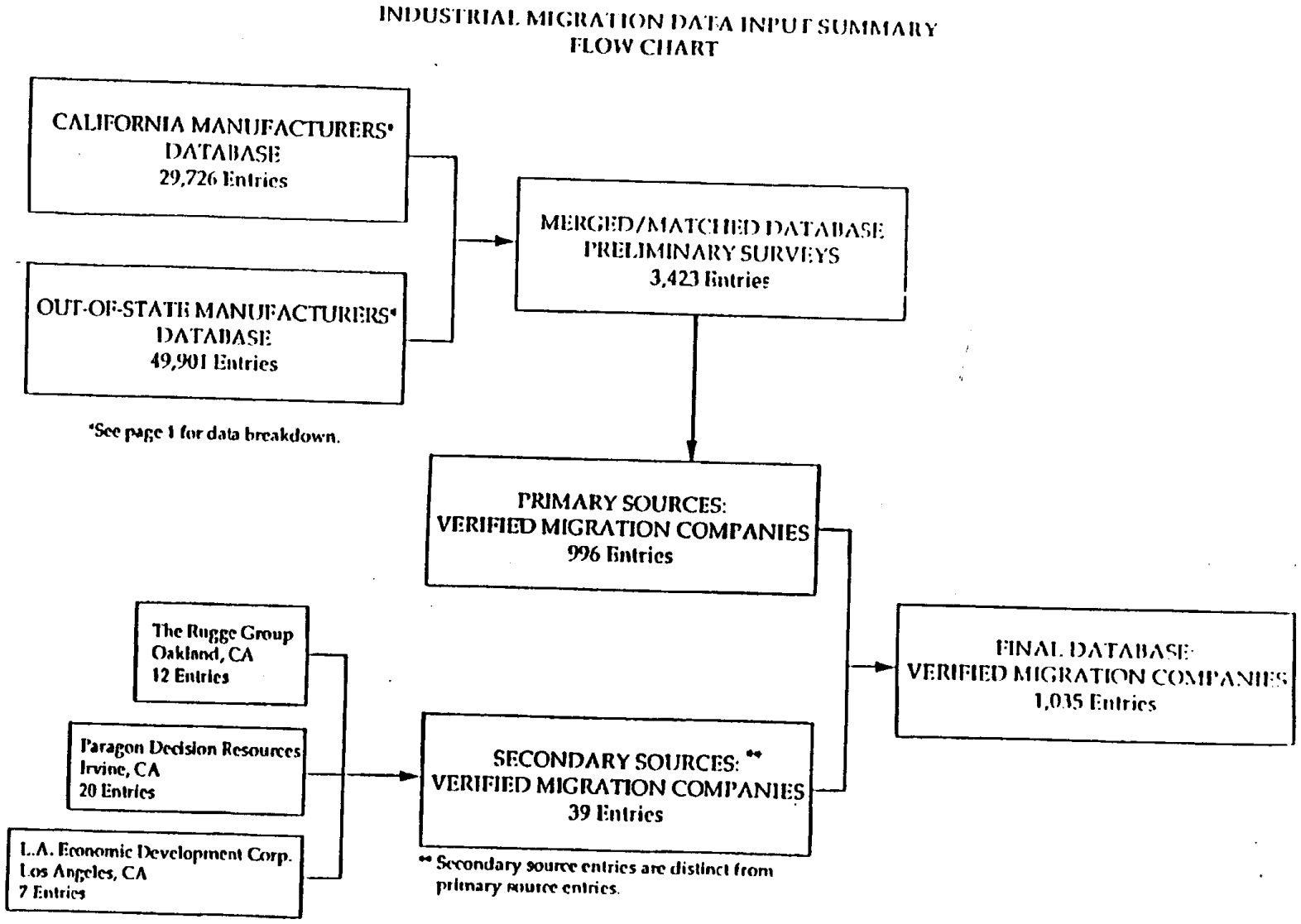
Table 7.9

Jobs Lost to Relocation/Expansion

Out of State

	1980-1992	Per Year
Direct job losses	96,333	8,028
Lost job opportunities (i.e., expansions)	58,811	4,901
Verified total jobs lost	167,593	13,966
Unverified jobs lost	56,733	4,728
Total Jobs Lost	224,326	18,694

Figure 7.6


INDUSTRIAL MIGRATION DATA INPUT SUMMARY
FLOW CHART
CALIFORNIA MANUFACTURERS* DATABASE
29,726 Entries
OUT-OF-STATE MANUFACTURERS* DATABASE
49,901 Entries
*See page 1 for data breakdown.
MERGED/MATCHED DATABASE
PRELIMINARY SURVEYS
3,423 Entries
PRIMARY SOURCES:
VERIFIED MIGRATION COMPANIES
996 Entries
The Rugge Group
Oakland, CA
12 Entries
Paragon Decision Resources
Irvine, CA
20 Entries
L.A. Economic Development Corp.
Los Angeles, CA
7 Entries
SECONDARY SOURCES: **
VERIFIED MIGRATION COMPANIES
39 Entries
** Secondary source entries are distinct from primary source entries.
FINAL DATABASE:
VERIFIED MIGRATION COMPANIES
1,035 Entries

The industry migration study utilized several large databases of manufacturing firms to produce a preliminary list of over 3,000 possible relocations (Figure 7.6). Interviews with all of these firms produced a final database of over 1,000 companies from which the data in Tables 7.9 and 7.10 were compiled.

Three kinds of business location activity were tracked:

- Actual relocations
- Expansions that were "lost" to other states
- An estimate of additional "unverified" losses based on analysis of firms with missing or incomplete data.

Expansions that were "lost" to other states represent expansions of firms in California that were located in other states. An expansion was counted as "lost" even if the firm had never indicated any interest in expanding in California.

A complete list of the survey data by years is presented below in Table 7.10. Data for 1993 and 1994 have been included.

Table 7.10

Southern California Job and Facility Losses

Due to Relocations and Expansions: 1980-1993

Year	Facilities	Jobs
1980	34	5,351
1981	30	8,324
1982	48	11,495
1983	45	8,126
1984	48	7,531
1985	71	15,657
1986	81	8,522
1987	116	20,612
1988	109	14,468
1989	138	17,639
1990	176	29,531
1991	203	16,648
1992	228	18,234
1993 (est.)	105	4,955

Source: Bules and Associates

The annual data show clearly that relocation activity is an ongoing part of the California economy.

- The number of relocations and "lost" jobs rose in the late 1980s when the California economy was booming.

- From 1987 through 1989 there were 52,719 "lost" jobs from relocations.

- The level of relocations continued to rise during the 1990-1992 period, when the California economy was in recession. The number of relocations from 1990 through 1992 was 64,413 or about 4,000 per year more on average than during the late1980s.

- Relocation activity appears to have declined in 1993. Based on preliminary data, the number of jobs associated with business relocations was lower in 1993 than in 1981.

- In the four recession years from 1990 through 1993 there were 69,368 jobs "lost" to relocations or "lost" expansions—an average of approximately 17,000 jobs per year. About 10,000 jobs per year left the state from direct relocations.

7.6 Business Relocations, Business Climate and Air Quality Regulations

There are three kinds of evidence needed for linking the existence of business relocations and related job losses to air quality regulations.

- The link between business relocations and job losses

- The link between business climate issues and business relocations

- The link between air quality regulations and relocations caused by business climate deficiencies in California.

As shown on Table 7.10 the level of business relocations was not substantially higher during the recession than in the preceding three years when the economy was growing. Thus there is no clear link between the level of relocation activity and the overall rate of job growth.

Based on the pattern of relocation activity in Table 7.10 (which includes "lost" expansions and unverified estimates) and given the highly concentrated nature of recent job losses (aerospace related, construction, and retail trade), a strong case does not exist to link business relocation activity to the recent economic downturn in California.

Firms are always changing the location of specific operations and there have always been a certain number of jobs relocating away from California.

The Commission on State Finance examined data for 1984-1988 (a period of substantial economic growth) and found:

This data show that California added a net of 1.6 million jobs between 1984 and 1988. However, underlying this net gain was 5.2 million new jobs from the creation of new business and the expansion of existing firms, but also 3.5 million job losses from business closures, relocations and layoffs.

...Business closure, relocations, failures, and cutbacks are the normal part of an economy— even in prosperous times such as the mid-1980s.

The full data set for 1984-1988 is reprinted below as Figure 7.7.

7.6.1 Business Relocation and Business Climate

Not all business relocations are caused by business climate issues. Figure 2.3 from the California Industry Migration Study lists several other reasons.

- Quality of life
- Business Strategy
- Business Requirements
- Direct Business Costs

Firms clearly move for a variety of reasons.

Figure 7.7

The Dynamic Nature Of Job Markets In California

Over the past year, there have been numerous reports in California of business closures and out-of-state relocations. In some instances, these reports do reflect deteriorating perceptions about business conditions in California. However, it is important to keep such reports in perspective. While they are clearly a cause for concern, they are not a cause for panic.

In a huge and dynamic economy such as California, businesses are always forming and dissolving, hiring and laying off employees. This is illustrated in Table D, which displays information collected by the California Department of Commerce on sources of job growth in the mid-1980s. This was a period of healthy economic growth.

This data shows that California added a net of 1.6 million jobs between 1984 and 1988. However, underlying this net gain was 5.2 million new jobs from the creation of new businesses and the expansion of existing firms, but also 3.5 million job losses resulting from business closures, relocations and layoffs.

As this table shows, business closures, relocations, failures, and cutbacks are the normal part of an economy— even in prosperous times such as the mid-1980s. Thus, the mere existence of these developments—especially in the midst of a national recession—is not sufficient evidence on which to conclude that the California economy is in permanent structural decline. A more conclusive test will come once the economic downturn has concluded, and national growth has resumed. Structural decline in the 1990s would be characterized by chronically higher plant closures and job losses and chronically lower levels of business formation and plant expansions relative to past history.

TABLE D
SOURCES OF NET JOB GAINS IN CALIFORNIA
1984-1988 BY INDUSTRY
(Thousands of Employees)

	New Firms	Firm Expansions	Firm Dissolutions	Firm Contractions	Net Gain
Agriculture	53.5	31.5	-43.5	-18.0	23.5
Mining	13.5	5.6	-24.3	-8.0	-13.2
Construction	199.5	111.0	-145.8	-63.0	101.7
Manufacturing	797.1	355.9	-800.8	-189.4	162.8
Nonelectrical Equipment	116.7	54.7	-112.7	-28.9	29.8
Electronics Equipment	149.3	67.2	-155.2	-36.6	24.7
All Other Manufacturing	531.1	234.0	-532.9	-123.9	108.3
Utilities	225.0	78.7	-179.7	-40.1	83.9
Wholesale Trade	253.6	116.9	-215.8	-45.3	109.4
Retail Trade	815.3	191.7	-481.8	-99.4	425.8
Finance, Insurance & Real Estate	290.2	156.8	-211.0	-81.8	154.2
Services	1,094.2	420.8	-735.6	-191.3	588.1
Business Services	459.8	171.8	-232.8	-53.8	345.0
Other Services	634.4	249.0	-502.8	-137.5	243.1
TOTAL	3,741.9	1,468.9	-2,838.3	-736.3	1,636.2

Annual Long-Term General Fund Forecast, Fall 1991

In recent years corporate restructuring has increased. Firms have reduced payrolls and consolidated facilities in response to market declines and cost pressures. This trend has been especially prominent in the aerospace industry and in some of the older diversified manufacturing industries like chemicals, paper, metal products and food processing.

While it is possible that business climate issues play a role in some California restructuring, it is likely that most restructuring reflects wage costs or corporate strategy considerations.

7.6.2 Air Quality Regulations and Business Climate Induced Relocations

The project work plan included a survey designed to gather qualitative and quantitative information on the impact of air quality regulations on California's recent job losses. As reported above in Chapter 6, the survey did provide qualitative information on how respondents viewed air quality regulations.

The survey results in Chapter 6 supported the findings from business climate surveys reviewed in Chapter 2. Many respondents are dissatisfied with and angry about the implementation of air quality regulations in California.

Unfortunately, the survey did not produce quantitative results which could be relied upon to derive dependable conclusions with regard to the issues under study. Our survey, like the business climate studies reviewed in Chapter 2, produced no reliable quantitative information on either the costs associated with air quality regulations or the related job impacts.

Two other approaches were used to make a quantitative assessment of the impacts of air quality regulations on business location decisions during the 1990-1993 period: 1) a judgmental assessment of how much of the reported relocations could be attributed to air quality regulations and 2) a review of recent job impact estimates of future air quality regulations prepared in 1994 by the South Coast Air Quality Management District (SCAQMD).

7.6.3 Air Quality Regulations and Business Relocations

The evidence presented above indicates that increased business relocations (from whatever cause) were not a significant factor in California's recent job losses. Nevertheless, it is of interest in this study to assess the role that air quality regulations may have had in the relocations that did occur.

What was the role of air quality regulations in these relocations? We know two facts from the Chapter 2 and Chapter 3 reviews of location decisions.

- There are many business climate factors potentially capable of affecting location decisions in California.

  — Workers' compensation
  — Liability laws
  — Tax policy
  — Land use and business permitting processes
  — The state fiscal situation
  — Regulations including air quality regulations

- Most studies rated regulatory reform as one key business climate concern but somewhat behind workers' compensation and other concerns.

As a result, there was and is fierce competition to attribute relocations to specific business climate issues. If air quality regulations were an equal cause of job loss with the other five business climate concerns listed above, regulations could be associated with one-sixth of the relocated jobs.

On the other hand the impact of direct costs imposed by air quality regulations falls heavily on industries with relatively few jobs.

In Chapter 4 in the discussion of the air quality control costs six industries were identified as accounting for 80% of the total estimated SCAQMD cost estimates. As shown below in Table 7.11, two of the six industries - SICs 36 and 37 - did account for over 20% of California job losses. However, as shown above the great majority of these job losses were associated with nationwide trends in aerospace and high tech industries. The other four industries on Table 7.11 accounted for just over 2% of state's job losses.

Table 7.11
California Job Trends in High Pollution Cost Industries

SIC CODE	Industry	Percentage of Total Cost	% of Non agricultural Jobs in CA June 1990	Job Change June 90-Dec 93 (Thousands)
49	Electric, Gas and Sanitation Services	30.0%	0.7%	3.6
29	Petroleum & Coal Products	22.4%	0.2%	-4.0
36	Electronic & Other Electric Equipment	9.7%	2.0%	-39.7
10 - 14	Oil & Gas Extraction, Mining	8.9%	0.3%	-3.9
37	Transportation Equipment	5.2%	2.3%	-91.4
75	Auto Repair Service	3.8%	1.5%	-6.9*
	Total NonAg Wage & Salary	100.0%	100.0%	-531.8

* Combined data for SICs 75 and 76

Note: Job data are seasonally adjusted

7.6.4 SCAQMD Socioeconomic Assessment

As part of the development of Air Quality Management Plans (AQMPs), the SCAQMD staff prepares a socioeconomic assessment of the plan. Included in the socioeconomic assessment is an estimate of the impact on jobs of the combined impact of all of the measures included in the plan.

The latest socioeconomic assessment was published in August 1994 in conjunction with review of the 1994 AQMP. The analysis covers impacts in the four county District area through the year 2010.

Job impacts are assessed through the use of a regional economic impact model. The costs of air quality control measures are estimated. All costs are assumed to be additional costs of doing business in the region. The impact of these additional costs on production and jobs is assessed with the model. This is the approach that would have been followed in this study if usable cost data had been developed in the survey.

The results of the SCAQMD analysis are shown below on Table 7.12 and 7.13. The entire plan would result in 63,049 fewer jobs in the year 2010. This is equal to a change of 0.59% in the region's job total.

Another way of viewing the results is that job growth in the region would be 1.92% per year with the AQMP measures versus 1.97% per year without the measures.

Table 7.12

Total Job Impacts of the Draft Plan

Quantified/Unquantified/Total	Average Annual (1994-2010)	Percent of Total Jobs in 2010
Quantified Measures and Benefits	+38,152	0.35%
Unquantified Measures	-101,201	-0.94%
Total	-63,049	-0.59%

Source: Socioeconomic Assessment Report for the 1994 Air Quality Management Plan, South Coast Air Quality Management District, August 1994, p. 4-6.

Table 7.13

Job Growth With and Without the Draft 1994 AQMP

Year	**without AQMP**	**with AQMP**
1994	7,865,460	7,887,909
2010	10,752,570	10,689,521
Annual Growth Rate (1994-2010)	1.97%	1.92%

Source: Socioeconomic Assessment Report for the 1994 Air Quality Management Plan, South Coast Air Quality Management District, August 1994, p. 4-6.

Since there are more air quality regulations and costs in the AQMP than exist today, it is unlikely that current air quality regulations could have larger relative job impacts than those identified in the SCAQMD socioeconomic analysis.

7.7 Revised Estimates of California's Job Losses

Revised estimates of non agricultural wage and salary jobs were published by the California Employment Development Department (EDD) in March 1995. The revised estimates show that the low in jobs was reached in April 1993, not December 1993 as originally reported. Moreover, there were fewer jobs lost than originally reported.

The revised estimates are shown below in Table 7.14

Table 7.14

California

Non Agricultural Wage & Salary Jobs (Seasonally Adjusted)

	July 1990	April 1993	December 1993
As originally reported	12,542.6		11,940.3
As revised	12,540.6	12,017.4	12,071.1

Source: EDD

The peak job loss was originally reported as 602,300. The revised estimate of peak job loss is 523,200.

The analysis in Chapter 7 was not redone with the new data as the revisions were published close to the end of the project schedule.

7.8 Summary

The two questions posed at the beginning of Chapter 7 can be answered based on the evidence collected.

Only a small share of California's job losses can be attributed to business climate reasons and/or business relocations.

- The majority of California's actual job losses are found in

  - Aerospace and related manufacturing - reflecting the state's disproportionate share of an industry with declining civilian and military markets

  - Construction and related manufacturing - reflecting the sharp decline in construction activity after 1988 even though the state added over two million residents

  - A decline in general manufacturing activity - reflecting the aerospace and construction declines and nationwide corporate restructuring and productivity gains in the sector

  - Losses in retail sales and retail trade jobs in response to points 1 through 3 and which was much larger than the decline in income

- The geographical pattern of California job losses supports the findings that specific sector trends caused the majority of job losses. Los Angeles County had over 70% of the statewide job losses and Los Angeles had an above average share of aerospace and construction declines.

- The high concentration of job losses in one county as well as the above average performance of California's high tech sector is not consistent with the hypothesis that statewide business climate issues were significant contributors to California's job losses.

- Business relocations occur in good as well as bad economic periods. Survey results indicate that fewer than 70,000 manufacturing jobs were relocated out of state during the 1990-1993 period. Moreover, the rate of relocations was only slightly higher during California's economic downturn than during the mid 1980s when California added nearly 400,000 jobs per year.

- Not all business relocations are the result of business climate concerns. Survey results show many other business reasons for relocation.

Only a small share of the job loss associated with business climate concerns and business relocations can be attributed to the role of air quality regulations.

- Neither this study or any of the studies reviewed in Chapter 2 contained quantitative evidence of job losses associated with air quality regulations though in most studies respondents expressed concern with how air quality regulations are implemented in California.

- Business climate studies list many business climate reasons why job losses and/or relocations may have occurred.

- Worker's compensation
- Liability laws
- State taxes
- Land use and other permitting issues

- State fiscal concerns
- Regulatory policies

Air quality regulations are not the top area of concern.

As a result it is likely that only a small portion of the business climate related job losses/relocations can be specifically attributable to air quality regulations. This is particularly true given the relatively small share of total costs devoted to air quality regulations as reported in Chapter 4 and the relative similarity between costs in California and other states.

- The South Coast Air Quality Management District estimates that implementation of all future air quality control measures in the region will cause an average difference in 2010 job levels of 63,000 jobs or 0.59% of the District's job base. It is not likely that existing regulations would have as great a relative impact as all future regulations combined.

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APPENDIX A

SCAQMD COST ESTIMATES

RULE NO.	BRIEF SUMMARY OF RULE	ADOPTION DATE	DATE OF CONTROL COSTS	LAST DATE OF AMEND.
108	Alternative Emission Control Plans	2-Mar-90	1989	6-Apr-90
403	Fugitive Dust	7-May-76	1990	6-Nov-92
403.1	Wind Entrainment of Fugitive Dust	16-Jan-93	1990	
431.1	Sulfur Content of Gaseous Fuels	4-Nov-77	1987	2-Oct-92
431.2	Sulfur Content of Liquid Fuels	2-Dec-77	1990	4-May-90
1106.1	Pleasure Craft Coating Operations	1-May-92	1990	
1107	Coating of Metal Parts and Products	1-Jun-79	1985	2-Aug-91
1109	Control of NOx from Refinery Heaters and Boilers	12-Mar-84	1988	5-Aug-88
1110.1	Stationary IC Engines	26-Oct-84	1987	4-Oct-85
1110.2	Gaseous-and Liquid-Fueld IC Engines	3-Aug-90	1989	7-Sep-90
1122	Solvent Degreasers	2-Mar-79	1990	5-Apr-91
1124	Aerospace Assy and Component Mfg Operations	6-Jul-79	1989	4-Dec-92
1129	Aerosol Coatings	2-Nov-90	1990	
1130.1	Screen Printing Operations	2-Aug-91	1991	
1134	NOx from Stationary Gas Turbines	4-Aug-89	1987	
1135	NOx from Elec Power Generating Systems	4-Aug-89	1992	19-Jul-91
1136	Wood Products Coatings	16-Sep-83		2-Aug-91
1142	Marine Tank Vessel Operations	19-Jul-91	1990	
1146	NOx from Ind'l, Instit'l, Comm'l Boilers, Steam Gen, Process Heat	9-Sep-88	1986	6-Jan-89
1146.1	NOx from Small Ind'l, Instit'l, Comm'l Boilers, Steam Gen	5-Oct-90	1990	10-Jul-92
1149	Storage Tank Degassing	4-Dec-87	1988	1-Apr-88
1151	Motor Vehicle/Mobile Eqpt Non-Assy Line Coating Operations	8-Jul-88	1990	6-Sep-91
1153	Commercial Bakery Ovens	4-Jan-91	1990	
1164	Semiconductor Manufacturing	8-Jul-88	1987	7-Dec-90
1168	Control of VOC Emissions from Adhesive Applications	7-Apr-89	1990	4-Dec-92
1173	Fugitive Emissions of VOC	7-Jul-89	1989	7-Dec-90
1175	Control of Emissions from Manufacture of Foam	3-Nov-89	1989	5-Jan-90
1176	Sumps and Wastewater Separators	3-Nov-89	1989	5-Jan-90
1179	Publicly Owned Treatment Works Operations	7-Jun-91	1989	6-Mar-92
1401	New Source Review of Carcinogenic Air Contaminants	1-Jun-90	1986	7-Dec-90
1403	Asbestos Emissions from Demolition/Renovation Activities	6-Oct-89	1989	
1405	Control of Ethylene Ox and CFC from Sterilization/Fumigation Proc	21-Dec-90	1990	4-Jan-91
1406	Control of Dioxins Emissions from Medical Waste Incinerators	5-Apr-91	1990	
1410	Hydrogen Fluoride Storage and Use	5-Apr-91	1990	
1411	Recovery/Recycling of Refrigerants from Motor Vehicle A/C's	1-Mar-91	1990	
1415	Reduction of CFC from Stationary Refrigeration and A/C Systems	7-Jun-91	1991	
1420	Emissions Standard for Lead	11-Sep-92	1990	

AQMD REGULATIONS

RULE NO.	TOTAL CONTROL COSTS PER YEAR (IN $ MILLIONS)	SIC CODE OF IMPACTED INDUSTRIES	COMMENTS
108	no direct costs	15-17, 20-39, 75	requires further reduction for Rules 1104,06,07,15,24,25,28,30,36,45,51,64,68
403	2.3 - 9.14	10-14, 15-17, 29, 32, 49, 52, 50-51, 65	costs and job impacts related to directly affected industries
403.1	1.48	01-07, 10-14, 15-17, 29, 32, 49, 50-51, 65	costs and job impacts related to directly affected industries - Coachella Valley only
431.1	0.7275	29, 49	16 petroleum refineries, 18 sewage plants, 26 landfills
431.2	2.7	29	20 petroleum refineries
1106.1	0.385	37, 44	
1107	0.48 - 3.67	25, 33, 34, 35, 36, 37	1,450 affected facilities
1109	32	29	initial cap costs = $412M.Control costs retd to economy in terms of creating jobs
1110.1	2.6 - 7.3	none listed	NOx control eqpt on all engines after 1995 are estimated at $20 million - 800 engines
1110.2	156.9	10-17, 20-39,42,45, 8,49,53,70,73,78,80,91-97	cost by industry(public & private), 3,729 engines,direct job impacts
1122	1.3	33, 34, 35, 36, 39, 75	cost by industry, affects 2,460 degreasers, job impacts
1124	(1.7) - 20	37	
1129	24.8	28, 51, 52	costs are from lost revenue, not out-of-pocket expenses, job impacts
1130.1	0.715	23, 27, 28, 51	affects approx 910 facilities, cost and job impacts by industry
1134	25.4 - 48.2	29, 26, 49	35 firms affected (17 listed by name)
1135	41	49	affects SCE, LADWP, Burbank and Glendale Public Svc Dept, Pasadena WP
1136	0.68 - 4.271		annualized costs depend on method of compliance
1142	32.1	29, 44	job impacts
1146	0.0445 - 0.4454	none listed	130 boilers affected
1146.1	4.0 - 4.7	affects nearly every sector, esp 82, 65	job impacts and cost impacts by industry and county!
1149	0.565 - 6.909	28, 29	controlled only during high-ozone season (May-Oct)
1151	23.68	37, 55, 75	approx 4,000 facilities, figures based on amendment not original adopted rule
1153	1.33 - 1.77	20	30 bakeries affected (local & grocery store bakeries exempt)
1164	45		list of semiconductor companies in SCAQMD
1168	0.002-0.110	28,17,25,75,others	
1173	36	29, 28, 13, 46	
1175	3.643	22, 24, 26, 28, 30, 32, 34, 37, 38, 39	4137 affected firms
1176	11.33	49, 13, 29, 28 46	HUGE list of firms with sumps/wastewater separators
1179	2.116 - 2.55		22 publicly owned treatment works (POTW), list of firms
1401	0.002 - 14.7	wide range of industries, 17	detailed list of range of compliance costs, facilities by SIC, eqpt affected
1403	0.0029 - 1.14*	15, 16, 17, 44, 65	20462 affected buildings (*one time charge for each building)
1405	0.223	80, 07, 38, 87, 20	200 affected facilities
1406	0.202 - 2.259	80, 49	12 hospitals, 1 comm'l waste incinerator
1410	2.5	28, 29	compliance cost ranges from implementation to phaseout in 1997,job impacts
1411	5.6	75, 55, 50	cost by industry, job impacts
1415	3.899 - 10.787	54, 59, 42, 29, 28, 79, 65, 76	cost by industry, job impacts
1420	9.3	33, 36, 37, 34, 32, 28	

TOTAL FIRMS IMPACTED
BY REGULATIONS

12/20/94

SIC CODE	108	403	403.1	431.1	431.2	1106.1	1107	1109	1110.1	1110.2	1122	1124	1129	1130.1	1134	1135	1136	1142	1146	1146.1
unknown					249,143															73
01 - 07															1					18
10 - 14*	19,503																			1
15 - 17	26,936																			6
20 - 39															1					
20																				139
22																				33
23																				13
24																				8
25																				8
26															4					5
27														2,242	1					19
28															3					85
29				20	20										3					10
30																				36
31																				
32																				34
33																				15
34																				66
35																				25
36																				98
37						65						325			1					97
38																				16
39																				2
40																				1
41																				2
42																				16
43																				2
44						25														
45															1					5
46																				
47																				3
48																				8
49				211											13	5				15
50 - 51																				37
52 - 59																				51
60															1					14
61																				11
62																				3
63																				12
64																				6
65 - 69																				296
70																				131

TOTAL YEARLY
COST OF COMPLIANCE

12/20/94

SIC CODE	108	403	403.1	431.1	431.2	1106.1	1107	1109	1110.1	1110.2	1122	1124	1129	1130.1	1134	1135	1136	1142	1146
unknown	0.1137					0.186			7.3								4.271		0.4454
01 - 07	0.003		0.21							31.161					0.954				
10 - 14*	0.0037	1.96																	
15 - 17	0.0027	4.1	0.88												0.799				
20										0.134									
22	0.0013																		
23										0.176					12.137				
24	0.0614													0.715	0.302				
25	0.0037									0.012					1.405				
26	0.0049									26.013					16.101				
27	0.0049																		
28																			
29		0.14	0.01	0.653	2.7			32											
30										0.006	0.035								
31	0.0037										0.193								
32	0.0139	0.15								0.01	0.278								
33											0.113								
34						0.144				0.205		20			0.399				
35																			
36	0.0758										0.084								
37	0.1199																		
38										0.084									
39																			
40																			
41																			
42																			
43										0.127					0.889				
44						0.055													
45																			
46										0.124									
47																			
48										0.124									
49		2.4	0.1	0.134						86.435					11.47	41			

These rules do not have costs directly associated with SIC Codes.

1107: 25, 33-37
1129: 28, 51, 52
1142: 29, 44
1149: 28, 29
1175: 22, 24-28, 30, 32, 34-39
1401: many SIC Codes
1405: 07, 20, 38, 80, 87

TOTAL YEARLY
COST OF COMPLIANCE

12/20/94

50 - 51		0.3																	
52 - 59		0.12																	
60										0.02									
61															0.282				
62																			
63																			
64																			
65 - 69		0.24	0.27																
70																			
72										0.071									
73																			
75										11.308									
76											0.62								
78																			
79										0.238									
80																			
81										0.537					1.691				
82																			
83															1.988				
84																			
86																			
87																			
89																			
91 - 97																			
99										0.28									
TOTAL	0.4126	9.41	1.47	0.787	2.7	0.385	0	32	7.3	156.921	1.323	20	0	0.715	48.217	41	4.271	0	0.4454

These rules do not have costs directly associated with SIC Codes.

1107: 26, 33-37
1129: 28, 51, 52
1142: 29, 44
1149: 28, 29
1175: 22, 24-28, 30, 32, 34-39
1401: many SIC Codes
1405: 07, 20, 38, 80, 87

TOTAL YEARLY
COST OF COMPLIANCE

12/20/94

SIC CODE	1146.1	1149	1151	1153	1164	1168	1173	1175	1176	1179	1401	1405	1406	1410	1411	1415	1420
unknown	0.2237																
01 - 07	0.0317					0.0029											
10 - 14*	0.0036					0.0036	6.3		2.6								
15 - 17	0.0116					0.0026											
20	0.5075			1.77													
22	0.1205					0.011											
23	0.0053																
24	0.0032					0.0596											
25	0.0032					0.0036											
26	0.0187					0.0048											
27	0.0098					0.0048											
28	0.3086						7.2		0.3					2			0.235
29	0.0041						21.6		8.1					0.5			
30	0.1196																
31						0.0036											
32	0.2033					0.0135											0.189
33	0.1191																5.582
34	0.2543																0.283
35	0.0102																
36	0.3569				45												0.839
37	0.3684		1.463														2.174
38	0.0552																
39	0.0041																
40	0.0041																
41	0.0008																
42	0.0095																
43	0.0008																
44																	
45	0.017																
46							0.9		0.3								
47	0.0012																
48	0.0033																
49	0.0395								0.03	2.55			0.165				

These rules do not have costs directly associated with SIC Codes.

1107: 25, 33-37
1129: 28, 51, 52
1142: 29, 44
1149: 28, 29
1175: 22, 24-28, 30, 32, 34-39
1401: many SIC Codes
1405: 07, 20, 38, 80, 87

TOTAL YEARLY
COST OF COMPLIANCE

12/20/9

50 - 51	0.0151																
52 - 59	0.0735		8.019												0.095		
60	0.0057														1.9		
61	0.0045																
62	0.002																
63	0.0049																
64	0.0024																
65 - 69	0.1234																
70	0.3184															9.84	
72	0.1685																
73	0.0195																
75	0.0134		14.197														
76	0.0008														3.605		
78	0.0085															0.947	
79	0.035																
80	0.1478																
81	0.0004												0.23				
82	0.2652																
83	0.013																
84	0.0042																
86	0.0391																
87	0.0012																
89	0.0158																
91 - 97	0.1514																
99	0.0053																
TOTAL	4.2578	0	23.679	1.77	45	0.11	38	0	11.33	2.55	0	0	0.395	2.6	5.6	10.787	9.302

These rules do not have costs directly associated with SIC Codes.

1107: 25, 33-37
1129: 28, 51, 52
1142: 29, 44
1149: 28, 29
1175: 22, 24-28, 30, 32, 34-39
1401: many SIC Codes
1405: 07, 20, 38, 80, 87

TOTAL FIRMS IMPACTED
BY REGULATIONS

12/20/94

72																				51
73																				45
75	1,502																			10
76																				2
78																				21
79																				67
80															3					162
81																				1
82															3					667
83																				32
84																				3
86																				65
87																				3
89																				20
91 - 97																				161
99																				13
TOTAL	47,941	N/A	N/A	231	249,163	90	N/A	N/A	N/A	N/A	N/A	325	N/A	2,242	35	5	N/A	N/A	N/A	2,743

TOTAL FIRMS IMPACTED
BY REGULATIONS

SIC CODE	1149	1151	1153	1164	1168	1173	1175	1176	1179	1401	1405	1406	1410	1411	1415	1420	TOTAL
unknown		1,000															250,216
01 - 07											175						193
10 - 14*						155		150									307
15 - 17					13,578					1,726							34,813
20 - 39																	
20			30													99	27,035
22					5		115										170
23																	153
24					245		65										13
25																	318
26					32		145										8
27					82												186
28						51	51	51		102			1				2,344
29						20		20					4				344
30							1,304										97
31					25												1,340
32					32		258			1							25
33																	323
34							910			384						126	141
35										45							1,360
36				29													70
37		1,000					377			326							127
38							222				12						2,191
39							682										250
40																	684
41																	1
42																	2
43																	16
44																	2
45																	25
46						15		15									6
47																	30
48																	3
49								79	22	485		1					8
50 - 51														646			831
52 - 59		1,000												3,163			683
60																	4,214
61																	15
62																	11
63																	3
64																	12
65 - 69																	6
70																	296
																	131

APPENDIX B

SURVEY INSTRUMENT

22. Have you moved in the last 3 years?

Yes _____ No _____

If yes, from _____

23. Are you planning to move/expand in the next 15 months?

Yes _____ No _____

24. What are the three most important factors in your location/expansion decision?

_____

_____

_____

Thank you for your cooperation.

California Air Resources Board

has contracted with

Institute for Economic and Environmental Studies
California State University, Fullerton

to conduct this important statewide survey
of California businesses

IT IS EXTREMELY IMPORTANT THAT
YOUR RESPONSES BE AS ACCURATE
AND COMPLETE AS POSSIBLE

ALL RESPONSES ARE STRICTLY CONFIDENTIAL
Individual responses will NOT be released.
Only statistical summaries will be made public.

Please complete and return the survey
in the prepaid envelope as soon as possible

Please feel free to call (714) 773-2509 if you have any questions.

COMPANY INFORMATION: Today's Date_____

Company Name_____

Street Address_____City_____Zip____

Respondent's Name_____Title_____

Telephone_____

What SIC (Standard Industrial Classification) number does your company fall under?

_____

What are the major products your company produces?_____

SURVEY QUESTIONS

1. Is this location:

   a. Company headquarters ☐

      Branch ☐ Subsidiary ☐ of_____

   b. Sole Proprietorship/Family Owned ☐

      Partnership ☐ Corporation ☐

2. In what year was your business established?_____

3. Rank the importance of the following in maintaining your business:

	IMPORTANT	SOMEWHAT IMPORTANT	NOT IMPORTANT
a. business climate	☐	☐	☐
b. labor costs	☐	☐	☐
c. proximity to markets	☐	☐	☐
d. proximity to suppliers	☐	☐	☐
e. quality of life	☐	☐	☐
f. government regulations	☐	☐	☐
g. site characteristics	☐	☐	☐
h. taxes, all	☐	☐	☐
i. transportation costs	☐	☐	☐
j. utility costs	☐	☐	☐

4. Of various government regulations listed alphabetically below, which affect you the most? Please rank these giving 1 to the one most relevant to your business and 5 to the least relevant.

	Rank
a) Air quality	____
b) Hazardous waste	____
c) Health & safety (OSHA, Workers Comp, etc.)	____
d) Labor standards (Min. wage, affirmative action etc.)	____
e) Other (Please list)	____

5. In the last three years, how much TOTAL money has your business spent on CAPITAL IMPROVEMENTS (new and existing) to satisfy the regulations listed below? Please indicate in absolute amount ($) as well as a percentage of your total capital expenditures.

a. New Capital Total for 3 years		% of total Capital
Air Quality	$_____	_____ %
Hazardous Waste	$_____	_____ %
Health & Safety	$_____	_____ %
Labor Standards	$_____	_____ %
Other listed above	$_____	_____ %

b. Retrofit (existing) Capital Total for 3 years		% of total Capital
Air Quality	$_____	_____ %
Hazardous Waste	$_____	_____ %
Health & Safety	$_____	_____ %
Labor Standards	$_____	_____ %
Other	$_____	_____ %

6. Over the last three years what is your best estimate of the ANNUAL AVERAGE cost of LABOR dedicated explicitly to meeting the listed regulations? Please indicate in absolute amount ($) as well as a percentage of your total operating costs.

	Absolute $ Annual Average	Percentage
Air Quality	$_____	_____ %
Hazardous Waste	$_____	_____ %
Health & Safety	$_____	_____ %
Labor Standards	$_____	_____ %
Other	$_____	_____ %

7. Over the last three years what is your best estimate of ADDITIONAL ANNUAL OPERATIONAL COSTS (materials, supplies etc.) your business incurred to meet the listed regulations? Please indicate in absolute amount ($) as well as a percentage of your total operating costs (annual average over last 3 years).

	Absolute $ Annual Average	Percentage
Air Quality	$_____	_____ %
Hazardous Waste	$_____	_____ %
Health & Safety	$_____	_____ %
Labor Standards	$_____	_____ %
Other	$_____	_____ %

8. Has your company benefitted by developing new products or processes as a result of *air quality regulations*? If so what are they and what, if any, are the *average annual* revenues (sales) generated from those?

New products/processes:_____

Annual Sales $_____ It is _____% of your total annual sales.

9. Has your competitive position with respect to other firms in California, the U.S., and the rest of the world been affected by compliance with the air quality rules.

Yes ☐ No ☐

In either case, please provide an explanation.

_____

_____

10. What percentage of your customers are located in:

a.	Southern California	_____%
b.	Northern California	_____%
c.	Central California	_____%
d.	Other states	_____%
e.	Outside the U.S.	_____%

11. What percentage of your supplies are purchased from:

a.	Southern California	_____%
b.	Northern California	_____%
c.	Central California	_____%
d.	Other states	_____%
e.	Outside the U.S.	_____%

12. How many firms do you actively compete against?

		Your Immediate Market	In California	Outside California
a.	less than 10	_____	_____	_____
b.	10-50	_____	_____	_____
c.	more than 50	_____	_____	_____

13. Please indicate gross annual sales for all products and services for the following years: [Check one box under each year]

		1990	1993
a.	$0 to $249,999	☐	☐
b.	$250,000 to $1 mill.	☐	☐
c.	$1 to $5 million	☐	☐
d.	$5 to $10 million	☐	☐
e.	$10 to $20 million	☐	☐
f.	$20 to $50 million	☐	☐
g.	$50 to $100 million	☐	☐
h.	$100 to $500 million	☐	☐
i.	$500 to $1 billion	☐	☐
j.	Over $1 billion	☐	☐

14. Do you own or rent your premises? Own ☐ Rent ☐

15. a) Number of employees (all locations) in your company in

1990 _____ 1993 _____ ?

b) How many locations do you have in California ____ in the U. S. ___ Outside The U.S.___?

Employment	At this Location	California Total	Outside California
10 or less	_____	_____	_____
11-25	_____	_____	_____
26-99	_____	_____	_____
100-499	_____	_____	_____
500-999	_____	_____	_____
1,000 or more	_____	_____	_____

16. What percentage of your total employees *at this location* work in the following job categories?

(i) Managerial/Profesional (Accountant, Legal, Marketing, Purchasing)	_____%	
(ii) Technical/Sales/Admin. Support	_____%	
(iii) Production (Machine Operators Assembelers, Inspectors, etc.)	_____%	**Total should add**
(iv) Material Handlers (Fork lift operators, drivers, etc.)	_____%	**up to 100% !**
(v) All Others	_____%	

17. How would you best describe your business (a or b)?	a or b	**Not Applicable**
a. Mass production with long production runs of standardized output or services, or		
b. specialty production/services that constantly change	____	
18. If you are a *manufacturer*, are the bulk of your goods sold best described as		
a. intermediate goods used in the production of other goods, or		
b. final goods, sold directly to wholesalers/ retailers, consumers, or the government	____	☐
19. If you are a *service provider*, do you sell mainly to		
a. households or government		
b. other businesses	____	☐

20. Please describe in your own words the 3 most important ways that air pollution regulations affect your business (e.g., timing of production, cost, quality, level of production, etc.)

i)

ii)

iii)

21. How have *air quality rules* affected the following aspects of your business? What is needed here is a qualitative description and a sense of importance in each area:

a. Direct costs (e.g. capital and operating expenses on control equipment)	**IMPORTANT** ☐	**SOMEWHAT IMPORTANT** ☐	**NOT IMPORTANT** ☐

Please describe:_____

_____

b. Indirect costs (delays, added transportation costs, waste disposal costs, etc.)	**IMPORTANT** ☐	**SOMEWHAT IMPORTANT** ☐	**NOT IMPORTANT** ☐

Please describe:_____

_____

c. Impact on markets, product quality, or goods produced:	**IMPORTANT** ☐	**SOMEWHAT IMPORTANT** ☐	**NOT IMPORTANT** ☐

Please describe:_____

_____

d. Impacts on inputs used and their mix:	**IMPORTANT** ☐	**SOMEWHAT IMPORTANT** ☐	**NOT IMPORTANT** ☐

Please describe:_____

_____

e. Impact on productive flexibility (e.g. ability to respond to customer needs, shifts in the market, etc.):	**IMPORTANT** ☐	**SOMEWHAT IMPORTANT** ☐	**NOT IMPORTANT** ☐

Please describe:_____

_____

f. Impact on your output	**IMPORTANT** ☐	**SOMEWHAT IMPORTANT** ☐	**NOT IMPORTANT** ☐

Please describe:_____

_____

APPENDIX C

LETTER FROM MR. KIRK WEST

CALIFORNIA CHAMBER of COMMERCE

KIRK WEST
PRESIDENT

April 14, 1994

Dear Colleague:

Under contract with the California Air Resources Board, California State University's Institute for Economic and Environmental Studies at Fullerton is investigating the role of air quality regulations in affecting business decisions to locate or expand in California or elsewhere. The public discussion on this issue has been hampered by lack of reliable information. All kinds of estimates are offered for the impact of these regulations which do not necessarily agree with each other. In fact, there is little hard data on the real costs and other impacts of these regulations on business location and expansion decisions.

For an accurate assessment of the costs and impacts of air quality regulations on business location decisions, the researchers from California State University, Fullerton have prepared the enclosed survey questionnaire to gather the cost and financial data needed for the study. The survey questionnaire has been prepared in consultation with a project advisory committee that included academics, business leaders, environmentalists, and labor representatives.

The study is intended to provide an objective assessment of the impact of air quality regulations on the business climate in California. I encourage you to take a few minutes of your valuable time to fill out the attached survey questionnaire. Please be assured that the information you provide will be kept confidential.

Sincerely,

Kirk West

APPENDIX D

REMINDER LETTER

Institute for Economic and Environmental Studies
School of Business Administration and Economics
California State University, Fullerton
Fullerton, California 92634-9480

Dr. Stewart Long, *Co-Director*
Dr. Anil Puri, *Co-Director*

Telephone: (714) 773-2509
Fax: (714) 773-3097

June 15, 1994

Dear California Businessperson:

About three weeks ago, our institute sent you a questionnaire in an effort to get information on the costs of air quality regulations that your company incurs.

Our Institute was commissioned by the California Air Resources Board to conduct this survey. We decided to take this project because we believe objective data are needed for this study and we counted on getting such information directly from people like you.

I am writing to you again because of the significance each completed survey has for the study to be useful. Your company's name was drawn through a scientific sampling process in which every company affected by air quality regulations had an equal chance of being selected. In order for the results to be truly representative, it is important that each questionnaire be completed and returned.

You may be assured of complete confidentiality. Your individual response will not be given to ARB. Only statistical averages will be reported. This questionnaire has an identification number for tracking so that we may check your name off the list for subsequent mailing of the questionnaire and reminders.

In the event that your questionnaire has been misplaced, or if you have any other questions, please call (714) 773-2509.

Sincerely,

Anil K. Puri, Ph.D.
Principal Investigator

APPENDIX E

COMMENTS BY FIRMS ON DETERMINANTS OF LOCATION

REPORT DOCUMENTATION PAGE

1. AGENCY USE ONLY *(Leave Blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
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Significance of California Air Pollution Control Regulations for Business Location Decisions

5. FUNDING NUMBERS
92-349

6. AUTHOR(S) Anil Puri, Stephen Levy, Kelly Robinson

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Institute for Economics and Environmental Studies School of Business Administration and Economics California State University, Fullerton
Fullerton, CA 92634-9480

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California Air Resources Board
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Release unlimited. Available from National Technical Information Service.
5285 Port Royal Road
Springfield, VA 22161

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13. ABSTRACT *(Maximum 200 Words)*

This study examined the relationship of air quality regulations to business location decisions in California. The study found that the primary cause of complaints about air pollution regulations is the complex, slow, and sometimes costly process of getting information about the regulations and obtaining permits. The study also found that compliance with air quality regulations in California imposed a relatively small cost on businesses (0.29 percent of revenues), and was only one of many factors in business location decisions. Further, business relocations were not a significant cause of the downturn of California's economy and job losses in the early 1990's.

14. SUBJECT TERMS
Business Location Decisions, Costs of Air Quality Regulations, Economic Impacts of Air Quality Regulations, California Business Climate, Regional Economic Competitiveness

15. NUMBER OF PAGES
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